Volume 1 of 1

BID SET ISSUANCE : JUNE 30, 2025

PROJECT MANUAL

Rockland BOCES

P-TECH C-TEC BUILDING

65 Parrot Rd, West Nyack, NY 10994

SED Control Numbers: 50-90-00-00-0-044-001

Architect: KSQ Design dba KSQ Architects P.C. 286 Madison Avenue, 22nd Floor New York, NY 10017 T. 646.435.0660	**Owner:** Rockland BOCES 65 Parrot Rd, West Nyack, NY 10994 T. 845.627.1764
MEP& Civil Engineer: Fellenzer Engineering LLP 22 Mulberry St, Suite 2A, Middletown, New York 10940 T. 845.343.1481	**Structural Engineer:** GACE Consulting Engineers 148 Madison Avenue, Fourth Floor New York, New York 10016 T. 212.545.7878
Food Service Consultant: Elite Studio E 1865 New Hwy #1 Farmingdale, New York 11735 T. 631.420.9400	**Construction Manager** Arris Contracting Company, Inc 189 Smith Street Poughkeepsie, New York 12601 T. 845.473.3600

Design conforms to applicable provisions of the New York State Uniform Fire Prevention and Building Code, New York State Energy Conservation Construction Code, and NY State Education Department Building Standards

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Project Name: ROCKLAND BOCES P-TECH C-TEC BUILDING

Contractor Name: _____

Respond to: _____

Fax Number: _____

Address: _____

_____

Subject: _____

Drawing/Reference No.: _____

Request: _____

_____

_____

_____

Reply: _____

_____

_____

_____

_____

By: _____ Date: _____

Request to: KSQ Design
Attn: Ofe Pearson
Email: opearson@ksq.design

Arris Contracting Company, Inc.
Attn: Chris Hanaburgh & Alexis Smith
Email: chanaburgh@arriscontracting.com
asmith@arriscontracting.com

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SECTION 00 10 00 - NOTICE TO BIDDERS

PART 1 - GENERAL

1.1 Rockland BOCES, Rockland County, NY, invites bid proposals for the following:

A. Rockland BOCES – P-TECH C-TEC Building

1.2 CONTRACT:

A. Single Prime Contracts will be let for:

1. General Construction – (GC)

1.3 SCHEDULE:

A. Bidding Documents Available:

1. At **12:00 p.m. on July 7th** Bidding Documents for the proposed project will be on file and publicly exhibited online at **www.revplans.com**

2. Copies of said Bidding Documents can be obtained from **Rev Plans, 330 Route 17A, Goshen, NY 10924** or **www.revplans.com**

3. Digital Download: Bid documents can be downloaded for **Forty Nine Dollars ($49.00).** Non-refundable fee payable by credit card from **www.revplans.com**

4. Hard Copy Drawings: $ 100 refundable upon return of set in good condition. Make checks or Money Orders payable to Rockland BOCES

5. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

6. All bid addenda will be transmitted to registered plan holders via email and will be available at **www.revplans.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.

B. Pre-Bid Conference:

1. Date & Time: **Tuesday, July 22, 2025 10:00AM**
2. Location: **Rockland BOCES**
3. Address: **65 Parrott Rd, West Nyack, NY 10994. Site Location**
4. District Contact: Assistant Superintendent for Business and Operations, Tawnya Muhlrad; 845-627-4721
5. Prospective bidders are strongly encouraged to attend.

C. Bid Due Date:

1. Sealed proposals will be received as indicated below, and at that time and place will be publicly opened and read aloud in the administrative conference room. All bidders shall comply with the General Municipal Law (103).
2. Date: **Tuesday August 12, 2025**
3. Time: **1:00 PM (local time)**
4. Location: **Rockland BOCES Boardroom**
5. Address: **65 Parrott Rd, West Nyack, NY 10994. Building #7**

D. Request for Information:

1. All pre-bid "Request For Information" (RFI) or Clarification (RFC) must be submitted NO LATER THAN **Tuesday, July 29, 2025 by 12:00pm (noon).** See specifications for appropriate form.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PROVISIONS:

A. Wages to workers, laborers and mechanics employed to work on this project, shall be paid in accordance with Section 220 of the Labor Law, and in accordance with the Prevailing Rate Schedules **(PRC #** found in the Project Manual**)** and proof of such payments will be required.

B. This project is publicly funded. The Bidders must comply with the New York State Department of Labor Prevailing Wage Rate Schedule and conditions of employment. This Contract will be subject to a Project Labor Agreement (PLA) to be entered into between Rockland BOCES ("Owner") and the Rockland County Building and Construction Trades Council, AFL-CIO, and its affiliated Local Unions on behalf of themselves and their members. The finalized PLA will be added to the Bid Documents as an Addendum prior to the deadline for submission of bids. By submitting a Bid, the contractor will be required to agree that the PLA is binding on the Contractor and Subcontractor of all tiers. The Bidder to be awarded the Contract, as well as the Bidder's Subcontractors, will be required to execute a "Letter of Assent" prior to the award. Failure to execute the Letter of Assent will result in rejection of the Bidder.

The Bidder is advised to, prior to submission of its bid, review the PLA once finalized and added as an Addendum.

Rockland BOCES reserves the right to waive any informalities or irregularities in the Bids received, to the extent permitted by law, or to reject all Bids without explanation.

C. Each bid for the single prime Contract must be identified, in typed format, on the outside of a sealed manila envelope, with the name and address of the bidder and designated as bid for the Project titled above and appropriate Contract number and name titled above. The Rockland BOCES 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 Rockland BOCES district, as well as improper hand delivery.

D. Each proposal must be accompanied by a certified check in the sum of five percent (5%) of the amount of the bid, drawn upon a National or State Bank or Trust Company, payable to the order of the Rockland BOCES, or a bond from a surety licensed to practice business in the State of New York with sufficient sureties in a penal sum equal to five percent (5%) of the bid, conditioned that if this bid is accepted, successful bidder will enter into a contract for the same and that he will execute such further security as may be required for the performance of the contract.

E. A separate Performance Bond, equal to one hundred percent (100%) of the contract amount will also be required of the successful bidders, and the bond shall be from a surety licensed to practice business in the State of New York, satisfactory to the School Board.

F. A separate Payment Bond, equal to one hundred percent (100%) of the contract sum will also be required of the successful bidders, and the bond shall be from a surety licensed to practice business in the State of New York, satisfactory to the School Board.

G. The bidders to whom the above referenced contracts may be awarded, shall within seven (7) days after the date of notification of the acceptance of their proposal, provide insurance and security as required by the above referenced contracts in a form acceptable by the Owner. In case of the bidders' failure to do so, or in case of the bidders' failure to give further security as herein prescribed, the bidders will be considered as having abandoned the same, and the certified check or other bid security accompanying the proposal shall be forfeited to the School District.

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

I. By Order of the Rockland BOCES

1. Dated: July 3, 2025
2. Ms. Tawnya Muhlrad, Assistant Superintendent for Business and Operations

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AIA® Document A701® – 2018

Instructions to Bidders

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

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

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

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6 POST-BID INFORMATION

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8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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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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User Notes: (640e2aeff442e4498d0968bb)

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 Bidding Documents, Contractor's Bid, the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General and Supplementary (if required) 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 prior to execution of the Contract, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

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

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

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

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

§ 1.8 A Bidder is a person or entity who has the authority to and does submit 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, and for whose pricing and work the Bidder is responsible.

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception;
- **.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
- .7 the Bidder is in compliance with section 220-i of the NY Labor Law, regarding registration with the New York State Department of Labor (DOL) before bidding on the Project and submission of a valid DOL certificate of registration with the bid, and, if awarded the work, the Bidder acknowledges its obligation to ensure that any subcontractor is registered with DOL prior to commencing any work on the Project.

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

- **.1** The corporation, partnership, sole proprietorship or 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

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type to this Project, within the last five (5) years, 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 able to perform the Work with manpower available to it; and

.6 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.)

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by written Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them. In the absence of a written interpretation, correction or change, should the Drawings disagree with themselves or with the Specifications, the Bidder shall rely on and estimate their bid based on the better quality, the costlier or the greater quantity of work or materials.

§ 3.2.4 Equivalency

§ 3.2.4.1 In the Specifications, if two or more kinds, types, brands, or manufacturers are named, they shall be 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, manufacturer or material other than those named in the Specification, then the Contractor shall indicate in writing to the Owner through the Construction Manager, prior to award of the Contract, what kind, type, brand or manufacturer is included in the Based Bid for the specified item.

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§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

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

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

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents. *(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)*

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

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

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid and further acknowledge that it is the Bidder's sole responsibility to confirm that the Bidder has received all Addenda issued.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

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

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

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

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

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

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

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

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

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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 written notice to the party designated to receive the Bids. Such written notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

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

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted, provided that notice of the error was given prior to awarding of the Contract or within three days after the opening of the Bid, whichever period is shorter. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

§ 4.4.4 Unless a bid error complies with § 4.4.3, a Bid may not be modified, withdrawn or canceled by the Bidder for a period of forty-five (45) days following the time and date designated for the receipt of Bids.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.1.1 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.

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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.

§ 6.2 Within forty-eight (48) hours after the Bids are opened, the two (2) apparent low Bidders must submit the required pre-award submittal package described below to the Construction Manager via email:

- **.1** Workforce and Work Plan – Provide a detailed written Work Plan which shall demonstrate the Contractor's understanding of overall Project scope.
- **.2** 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** Statement the Project can be completed in the established time.
- **.3** Resumes for the Bidder's proposed supervisory staff, including qualifications for specialized expertise or any certification(s).
- **.4** Any special coordination requirements with other trades.
- **.5** Any special storage and/or staging requirements for construction materials.
- **.6** Detailed Cost Estimate: A copy of a Detailed Cost Estimate outlined in CSI format by material and labor.
- **.7** A copy of the Bidder's two (2) most recent financial statements audited by a CPA or, if the Bidder has no audited financial statements, then the two (2) most recent financial statements prepared and/or reviewed by a CPA.
- **.8** A properly completed and executed AIA Document A305™-2020, Contractor's Qualification Statement.
- **.9** Required insurance certificates.
- **.10** A designation of the Work to be performed by the Bidder's own forces.
- **.11** Names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each.
- **.12** 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.
- **.13** Names, addresses and phone numbers of the subcontractors that the Bidder proposes to use on the Project;
- **.14** A description of the Bidder's experience with at least five similar projects (completed in the last five years) of comparative size, complexity and cost together with documentary evidence showing that said projects were completed to their respective owner's satisfaction and were completed in a timely fashion listing type and scope of work. Provide names, addresses and current phone numbers of owners, architect and Construction manager associated with each project.
- **.15** The Bidder's proposed site safety plan.
- **.16** Proposed list of submittals and a proposed schedule for making and issuing them, within the Bidder's proposed work plan and schedule;

§ 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), including sub-contractors, proposed for the principal portions of the Work.

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder in accordance with the Bid requirements and subject to the approval of the Owner.

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

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located and with an AM Best rating of Superior A+, A++ or Excellent A,A-.

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

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

§ 7.2.5 The Bidder is precluded from submitting any claims based on delay when such delay is caused by Bidder's failure to submit bonds that fully comply with the requirements of this Article 7 and the Bidding requirements.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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.2 AIA Document A132™–2019, Exhibit A, Insurance and Bonds, with insurance Rider
(Insert the complete AIA Document number, including year, and Document title.)

The Rider sets forth the insurance requirements promulgated by the New York Schools Insurance Reciprocal (NYSIR) applicable to capital construction projects.

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

.4 Building Information Modeling Exhibit, if completed:

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

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

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

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

Notice to Bidders, Instructions to Bidders, sample forms, and the Contractor's bid, pricing proposals submitted by the Contractor and accepted by the Owner.
Prevailing Wage Rate Schedules and respective updates

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SECTION **00 30 00 - GC BID FORM**
CONTRACT 1 – GENERAL CONSTRUCTION PROPOSAL (GC):

_____
Bidding Firm Name
To The Board of Education,
The undersigned hereby proposes to furnish all labor, materials, devices, appliances, supplies, equipment, services and other facilities necessary to complete all of the work of the above referenced Contract for Rockland BOCES, West Nyack, New York, as required by, and in accordance with, the provisions of the Instructions to Bidders, the Supplementary Instructions to Bidders, the Conditions of the Contract, the Drawings and Specifications, all as prepared by KSQ Design designated as Rockland BOCES P-TECH C-TEC Building, dated **June 30, 2025** and that, if this Proposal is accepted, the Undersigned agrees to enter into an Agreement with the owner to perform this work for the lump sum of:

_____

_____Dollars & No Cents

($_____ .00)
herein referred to as the Base Bid.

ALLOWANCES:
The undersigned Contractor has included the Allowance(s) as specified in Section 01 2100 in their Base Bid.

UNIT PRICE:
Unit Price No. 1: Construction Debris Removal
_____Dollars & No Cents

($_____ .00)

Unit Price No. 2: Trench Rock
_____Dollars & No Cents

($_____ .00)

Unit Price No. 3: Unsuitable Soil Removal
_____Dollars & No Cents

($_____ .00)

ALTERNATES:
Alternate No. 1: Mobile Workstations in Kitchen #1 (ADD):
_____Dollars & No Cents

($_____ .00)

Alternate No. 2: Canopy (ADD):
_____Dollars & No Cents

($_____ .00)

Alternate No. 3: 2nd Floor Roof Garden Concrete Pavers (ADD):
_____Dollars & No Cents

($_____ .00)

Alternate No. 4: Bullet Resistant Storefront (ADD):
_____Dollars & No Cents

($_____ .00)

Alternate No. 5: Site Trees (DEDUCT):
_____Dollars & No Cents

($_____ .00)

ADDENDA:
The undersigned acknowledges the receipt of the following addenda:

Addendum Number	Date	Addendum Number	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The Undersigned understands that the Owner reserves the right to accept or reject any or all proposals, but that if notice of the acceptance of the above Proposal is sent via United States Postal Service or any other overnight carrier, with signature required, to the Undersigned within sixty (60) days after the formal opening of Bids or anytime thereafter before this Proposal is withdrawn, the Undersigned will enter into, execute, and deliver a Contract within five (5) days after the date of said notification.

TIME OF COMMENCEMENT COMPLETION:
The Undersigned agrees in the Base Bid to complete the work as per the Milestone Schedule provided in Specifications.

REJECTION OF BIDS:
The Bidder acknowledges that the Owner reserves the right to waive any informality in, or to reject any or all Bids.

ATTACHMENTS:
Obtain and attach the following documents to each individual Bid:

a. Non-Collusive Bid Certification
b. Iran Divestment Act Affidavit
c. Bid Security
d. Insurance Affidavit
e. Substitution List
f. Subcontractor Listing
g. Each Bidder to submit a separate sealed list that names each subcontractor that the bidder will use to perform work on the contract, and the agreed-upon amount to be paid to each, for: (a) plumbing and gas fitting, (b) steam heating, hot water heating, ventilating and air conditioning apparatus and (c) electric wiring and standard illuminating fixtures.

WORK COST BREAKDOWN:
This form shall be filled out and submitted by the Contractor. The grand total must equal the BASE BID.

a. Bid Form, all costs must be shown by trade and totaled, failure to breakdown these cost will be subject to disqualification of the bid.

TRADE	BID VALUE
General Requirements	$_____
Allowances	$_____
Sitework	$_____
General Construction	$_____
Mechanical	$_____
Electrical	$_____
Plumbing	$_____
Fire Protection	$_____
Total (equal to bid amount)	$_____

CLOSING: (signature)_____

DATE: _____

BY: _____

TITLE: _____

FIRM: _____

ADDRESS: _____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

CONTACT PERSON: _____

E-MAIL: _____

Submit Bid Form in duplicate.

END OF SECTION 00 3000

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

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

OWNER:
(Name, legal status and address)

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)
Rockland BOCES P-TECH C-TEC Building

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 Twenty-seventh day of June , Two Thousand Twenty-Five

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

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CONTRACTOR AS PRINCIPAL *(Signature)*	**SURETY** *(Signature)*
(Printed name and title)	*(Printed name and title)*
(Witness)	*(Witness)*

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Variable Information

PAGE 1

PROJECT:
(Name, location or address, and Project number, if any)
Rockland BOCES P-TECH C-TEC Building

Signed and sealed this Twenty-seventh day of June , Two Thousand Twenty-Five

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_____

(Signed)

_____

(Title)

_____

(Dated)

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AIA® Document A305® – 2020

Contractor's Qualification Statement

THE PARTIES SHOULD EXECUTE A SEPARATE CONFIDENTIALITY AGREEMENT IF THEY INTEND FOR ANY OF THE INFORMATION IN THIS A305-2020 TO BE HELD CONFIDENTIAL.

SUBMITTED BY:
(Organization name and address.)

SUBMITTED TO:
(Organization name and address.)

TYPE OF WORK TYPICALLY PERFORMED
(Indicate the type of work your organization typically performs, such as general contracting, construction manager as constructor services, HVAC contracting, electrical contracting, plumbing contracting, or other.)

THIS CONTRACTOR'S QUALIFICATION STATEMENT INCLUDES THE FOLLOWING:
(Check all that apply.)

[ ] Exhibit A – General Information
[ ] Exhibit B – Financial and Performance Information
[ ] Exhibit C – Project-Specific Information
[ ] Exhibit D – Past Project Experience
[ ] Exhibit E – Past Project Experience (Continued)

CONTRACTOR CERTIFICATION
The undersigned certifies under oath that the information provided in this Contractor's Qualification Statement is true and sufficiently complete so as not to be misleading.

CONTRACTOR'S Authorized Representative *(Signature)*

(Printed name and title)

Date

NOTARY
State of:
County of:
Signed and sworn to before me this day of

Notary Signature
My commission expires:

ADDITIONS AND DELETIONS:
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_____

(Signed)

_____

(Title)

_____

(Dated)

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AIA® Document A305™ – 2020
Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

« »

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

« »

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

« »

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

« »

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

« »

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

« »

.2 If your organization is a partnership, identify its partners and its date of organization.

« »

.3 If your organization is individually owned, identify its owner and date of organization.

« »

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User Notes: (1211446851)

.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

« »

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

« »

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

« »

§ A.1.3.2 How many full-time employees work for your organization?

« »

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

« »

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

« »

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

« »

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

« »

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

« »

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

« »

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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« »

§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

« »

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

« »

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

« »

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

« »

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

« »

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

« »

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

« »

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AIA® Document A305™ – 2020
Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ B.1 FINANCIAL

§ B.1.1 Federal tax identification number:

« »

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

« »

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

« »

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

« »

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS

§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

« »

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 failed to complete work awarded to it?

« »

.2 been terminated for any reason except for an owners' convenience?

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« »

.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

« »

.4 filed any lawsuits or requested arbitration regarding a construction project?

« »

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

« »

.2 had any business or professional license subjected to disciplinary action?

« »

.3 been penalized or fined by a state or federal environmental agency?

« »

DRAFT

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AIA® Document A305™ – 2020 Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

« »
« »

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

« »

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

« »

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

« »

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

« »

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

« »

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

« »

§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

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User Notes: (1936929336)

« »

§ C.1.5 Identify portions of work that you intend to self-perform on this Project.

« »

§ C.1.6 To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

« »

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ C.2.1 Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may complete Exhibit E.

§ C.2.2 State the total dollar value of work currently under contract at the Contractor's Project Office:

« »

§ C.2.3 Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

« »

§ C.2.4 State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

« »

§ C.2.5 List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

« »

§ C.3 SAFETY PROGRAM AND RECORD

§ C.3.1 Does the Contractor's Project Office have a written safety program?

« »

§ C.3.2 List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

« »

§ C.3.3 Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ C.3.4 Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ C.4.1 Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

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§ C.4.2 If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

« »

§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.2? If so, identify.

« »

§ C.5 SURETY

§ C.5.1 If requested, will your organization be able to provide a performance and payment bond for this Project?

« »

§ C.5.2 Surety company name:

« »

§ C.5.3 Surety agent name and contact information:

« »

§ C.5.4 Total bonding capacity:

« »

§ C.5.5 Available bonding capacity as of the date of this qualification statement:

« »

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AIA® Document A305™ – 2020
Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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AIA® Document A305™ – 2020
Exhibit E

Contractor's Past Project Experience, Continued

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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SECTION 004503 – INSURANCE CERTIFICATION FORM

Name of Project: Rockland BOCES P-TECH C-TECH Building

YOUR INSURANCE REPRESENTATIVE MUST COMPLETE FORM BELOW IN ORDER TO BE CONSIDERED FOR THE AWARD OF THIS BID OR PROJECT, AND IT'S IMPORTANT THAT YOU COMPLETE THE BIDDER'S ACKNOWLEDGEMENT SECTION OF THIS FORM. PLEASE NOTE THAT THIS INSURANCE CERTIFICATE 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 AIA A232-2019 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 Owner may award the contract to the next lowest/responsive bidder.

Firm Name: _____

Address: _____

Date:_____ _____

Bidder's Signature

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SECTION 00 45 22 – SEXUAL HARASSMENT 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: _____ _

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SECTION 00 48 00 - NON-COLLUSIVE CERTIFICATION

PART 1 - GENERAL

1.1 The following provisions of the New York State General Municipal Law form a part of the Bidding Requirements:

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 his or her 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 so furnish with the Bid, a signed statement which sets forth in detail the reasons therefore. 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.

C. The fact that a bidder:

1. has published price lists, rates, or tariffs covering items being procured
2. has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or
3. 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 (A) (1), (2) and

D. 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 certification referred to in subdivision one 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 the corporation.

E. The person signing this Bid or Proposal certifies that he has fully informed himself 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 behalf.

CLOSING: (SIGNATURE)_____ (PRINT NAME) _____

TITLE: _____ DATE _____

COMPANY NAME: _____

ADDRESS: _____

ADDRESS: _____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

CONTACT PERSON: _____

E-MAIL: _____
:

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00 48 00

SECTION 00 48 01 – GENERAL MUNICIPAL LAW "IRANIAN ENERGY SECTOR DIVESTMENT"

The below signed bidder affirms the following as true under penalties of perjury:

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 that each bidder is not on the list created pursuant to paragraph (b) of subdivision 3 of Section 165-a of the state finance law.

Corporate or Company Name

BY: _____
Signature

_____
Title

Sworn to before me this

_____ day of _____, 20____

_____
Notary Public

END OF SECTION 00 48 01

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SECTION 00 48 01.1 – 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: _____

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SECTION 00 48 06 **-** WAGE DETERMINATION SCHEDULE

Per instructions from the New York State Education Department in “Office of Facilities Planning Newsletter #106 – May 2011”

The PRC number can be used by all prospective bidders to see the appropriate wage rates for the project by following the link:

https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1590570

PRC# 2025007082

Click on the “Wage Schedule” link near the top of the page.

This process may be used for SED approval and for the actual bidding process.

Prospective bidders must go to the DOL website with the PRC number provided and make certain their bid price is reflective of the actual wage rates for the particular project.

Once the District has identified a low bidder, DOL states that the contract must include the actual wage rates for the project.

(Facilities Planning Newsletters can be found online at:
http://www.p12.nysed.gov/facplan/NewsLetters.htm)

END OF SECTION 00 48 06

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AIA® Document A132® – 2019

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

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

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

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

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

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

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

The Owner and Contractor agree as follows.

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

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

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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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

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4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS
EXHIBIT B DETERMINATION OF THE COST OF THE WORK

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions) as amended, Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, the Notice to Bidders, Instructions to Bidders, sample forms, and the Contractor's bid, pricing proposals submitted by the Contractor and accepted by the Owner, 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. An enumeration of the Contract Documents, other than Modifications, appears in Article 9. In the event of a conflict between the Contract Documents, the order of precedence shall be as follows unless otherwise specified: (1) this Agreement (including all executed Exhibits), (2) Supplementary Conditions, (3) General Conditions (A232–2019), (4) Specifications, (5) Drawings. Ambiguities or inconsistencies shall be resolved by reference to the intent and scope described in the Agreement and the Specifications, with written clarifications and Modifications taking precedence.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

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.

[ ] 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.

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§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 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.)

§ 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

§ 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.

[ ] By the following date:

§ 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

§ 3.4.3 If the Contractor fails to substantially complete the Work of this Contract, or portions thereof, as provided in this Section 3.4, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

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

[ ] 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.

§ 4.2.2 Alternates

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

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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)

§ 4.6 Other:
(Insert provisions for bonus, cost savings or other incentives, if any, that might result in a change to the Contract Sum.)

The Contractor shall not be entitled to markup or overhead on Change Orders issued solely to correct errors, omissions, or non-compliant Work for which the Contractor is responsible, as documented in the Architect's or Owner's written notice.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and Certificates for Payment issued by the Construction Manager and Architect, the Owner shall make progress payments on account of the Contract Sum, to the Contractor, as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Construction Manager not later than the 5th day of a month, and the payment amount is undisputed, the Owner shall make payment of the amount certified to the Contractor not later than the last day of the month. If an Application for Payment is received by the Construction Manager after the application date fixed above, and the payment amount is undisputed, payment of the amount certified shall be made by the Owner not later than thirty (30) days after the Construction Manager receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 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. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Construction Manager and Architect may require. This schedule of values shall be used

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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.

§ 5.1.4.3 In accordance with AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as amended, 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;

.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 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; and

.5 Retainage withheld pursuant to Section 5.1.7.

5.1.6.4.1.1 and

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

§ 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.) Retainage may be reduced upon written approval of the Owner, based on verification that the Work is progressing satisfactorily, the Contractor is in compliance with the schedule, and no liens or claims have been filed.

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, when the Work of this Contract is substantially complete, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted when the Work of this Contract is substantially complete shall not include retainage as follows:
(Insert any other conditions for release of retainage when the Work of this Contract is substantially complete, or upon

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Substantial Completion of the Work of all Contractors on the Project or portions thereof.)

§ 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, 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 submitted a release, in form reasonably acceptable to the Owner, of liens and claims executed by the Contractor and by each of its subcontractors on behalf of whom payment is requested.

§ 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, or as follows:

§ 5.3 Payments due and unpaid under the Contract, which are not disputed, shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

Interest at the rate set forth in General Municipal Law 106-b(1)(c).

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, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker. Unless otherwise agreed in writing, all dispute resolution proceedings shall be conducted in the state and county in which the Project is located.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A232–2019, 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.

[ ] Other: *(Specify)*

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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 amended.

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019, as amended.

§ 7.3 Suspension

The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019, as amended; in such case, the Contract Sum and Contract Time shall be increased as provided in Article 14 of AIA Document A232–2019, except that the term "profit" shall be understood to mean the Contractor's Fee as described in Section 4.3.2 or 4.4.2, as applicable, of this Agreement.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2019 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)

§ 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 written 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 AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, Exhibit A, Insurance and Bonds, the Rider attached to AIA Document A132-2019, Exhibit A regarding insurance requirements, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A132™–2019, Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A232–2019, may be given in accordance with a building information modeling exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with a building information modeling exhibit, 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.)

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§ 8.8 Other provisions:

The Owner shall have the right to withhold payment or deduct amounts from the Contract Sum for documented material breaches of the Contract by the Contractor, including failure to maintain required insurance, materially deviating from the construction schedule, or noncompliance with applicable laws or regulations, provided the Contractor is given written notice and an opportunity to cure within the time specified in the General Conditions.

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 AIA Document A132™–2019, Exhibit A, Insurance and Bonds Exhibit, with insurance Rider

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

.4 Building Information Modeling Exhibit, if completed:

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.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.)

[ ] The Sustainability Plan:

Title	Date	Pages

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[ ] 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.)

Notice to Bidders, Instructions to Bidders, sample forms, and the Contractor's bid, pricing proposals submitted by the Contractor and accepted by the Owner.
Prevailing Wage Rate Schedules and respective updates

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

OWNER *(Signature)*

(Printed name and title)

CONTRACTOR *(Signature)*

(Printed name and title)

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AIA® Document A132® – 2019 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the day of in the year
(In words, indicate day, month, and year.)

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

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

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

TABLE OF ARTICLES

A.1 GENERAL

A.2 OWNER'S INSURANCE

A.3 CONTRACTOR'S INSURANCE AND BONDS

A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A232™–2019, General Conditions of the Contract for Construction, as amended.

The Contractor shall comply with the insurance and bonding requirements detailed in the Rider to AIA A132-2019 Exhibit A, titled "Sample Insurance Requirements- Capital Construction," which is incorporated herein by reference. In the event of any conflict between the terms of this Exhibit A and the Rider, the terms of the Rider shall control.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's

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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 Document A232™–2019, General Conditions of the Contract for Construction. Article 11 of A232™–2019 contains additional insurance provisions

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request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to false work and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's, Construction Manager's, and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

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§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[ ] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

[ ] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

[ ] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

[ ] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

[ ] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

[ ] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

[ ] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

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[ ] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information.
(Indicate applicable limits of coverage or other conditions in the fill point below.)

[ ] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. All certificates shall include a fully competed ACCORD 885 Addendum. For any "Yes" responses on items G through L of Accord 855, additional detail must be provided in writing. Endorsement s for General Liability, Auto Liability, and Umbrella/Excess coverages must be attached, including CG 20 38 and CG 20 37 or their equivalent. All insurance must be provided by insurers licensed and admitted in New York State and rated A- or better by A.M. Best. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self- insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, and as detailed in the Rider, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect and the Architect's consultants, and the Construction Manager and the Construction Manager's consultants, as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, and the Construction Manager and the Construction Manager's consultants, CG 20 32 07 04. A waiver of subrogation shall apply in favor of the Owner for all applicable coverage, including but not limited to General Liability, Auto Liability, Workers' Compensation, and Umbrella/Excess.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than one million dollars ($ 1,000,000.00) each occurrence, two million dollars ($ 2,000,000.00) general aggregate, and two million ($ 2,000,000.00) aggregate for products-completed operations hazard,

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providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;

.2 personal injury and advertising injury;

.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;

.4 bodily injury or property damage arising out of completed operations; and

.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the Work involves such hazards.

.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than one million dollars ($ 1,000,000.00) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than one million dollars ($ 1,000,000.00) each accident, one million dollars ($ 1,000,000.00) each employee, and one million dollars ($ 1,000,000.00) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than ($) per claim and ($) in the aggregate.

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§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[ ] **§ A.3.3.2.1** If there is only one Contractor performing the Work on the Project, property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

[ ] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for Work within fifty (50) feet of railroad property.

[ ] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than two million dollars ($ 2,000,000.00) per claim and two million dollars ($ 2,000,000.00) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[ ] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[ ] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

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[ ] **§ A.3.3.2.6 Other Insurance**

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	
Performance Bond	

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement. Surety companies must be licensed and admitted in New York State and rated A- or better by A.M. Best. Subcontractors are subject to the same bonding and insurance conditions as the Contractor, and certificates must be submitted for approval prior to any work. Failure to obtain such coverage may result in Contractual liability as described in the Rider.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

The Contractor agrees that failure to comply with the insurance provisions of the Rider constitutes a material breach of contract. The Contractor also agrees to indemnify, defend, and hold harmless the Owner, its Board, employees, and volunteers from claims arising from any subcontractor's failure to provide required insurance coverage.

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INSURANCE REQUIREMENTS – CAPITAL CONSTRUCTION

1. Notwithstanding any terms, conditions or provisions, in any other writing between the parties, the contractor hereby agrees to effectuate the naming of the BOCES, Construction Manager, and Architect as an Additional Insured on the contractor's insurance policies, except for workers' compensation and N.Y. State Disability insurance.

2. The policy naming the BOCES, Construction Manager, and Architect as an Additional Insured shall:

   a. Be an insurance policy from an A.M. Best A- rated or better insurer, **licensed and admitted** to conduct business in New York State. A New York licensed and admitted insurer is **required.**

   b. State that the organization's coverage shall be primary and non-contributory coverage for the BOCES, its Board, employees and volunteers, and Construction Manager, and Architect including a waiver of subrogation in favor of the BOCES for all coverages including Workers Compensation.

   c. Additional insured status for General Liability coverage shall be provided by standard or other endorsements that extend coverage to the BOCES, Construction Manager, and Architect for on-going operations (CG 20 38 or equivalent) and products and completed operations (CG 20 37 or equivalent). The decision to accept an endorsement rests solely with the BOCES. A completed copy of the endorsements must be attached to the Certificate of Insurance to include General Liability, Auto Liability and Umbrella/Excess coverages. A copy of the Acord 855 Form is required to be sent for review.

3. a. The certificate of insurance must describe **all services** provided by the contractor (e.g., roofing, carpentry or plumbing) that are covered by the liability policies.

   b. At the District's/BOCES' request, the contractor shall provide a copy of the declaration page of the liability and umbrella/excess policies with a list of endorsements and forms. If requested, the contractor will provide a copy of the policy endorsements and forms.

   c. There will be no coverage restrictions and/or exclusions involving New York State Labor Law statutes or gravity related injuries.

   d. No policies containing escape clauses or exclusions contrary to the Owner's interests will be accepted.

e. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACORD 855 2014/15) must be included with the certificates of insurance. For any "Yes" answers on Items G through L on this Form– additional details must be provided in writing. Policy exclusions may not be accepted.

4. The contractor agrees to indemnify the BOCES for applicable deductibles and self-insured retentions.

5. Minimum Required Insurance:

a. **Commercial General Liability Insurance**
$1,000,000 per Occurrence/$2,000,000 Aggregate
$2,000,000 Products and Completed Operations
$1,000,000 Personal and Advertising Injury
$100,000 Fire Damage
$10,000 Medical Expense
The general aggregate shall apply on a per-project basis. Products and completed operations coverage must remain in effect for **three years** after project completion and acceptance of the work performed.

b. **Owners Contractors Protective (OCP) Insurance**

For projects less than or equal to $1,000,000 and/or work on 1 story (10 feet) only.

$1,000,000 per occurrence, $2,000,000 aggregate with the BOCES as the Named Insured. There will be no Additional Insureds on any OCP Policies.

For projects greater than $1,000,000 and/or work over 1 story (10 feet);

$2,000,000 per occurrence, $4,000,000 aggregate with the BOCES as the Named Insured. There will be no Additional Insureds on any OCP Policies.

The OCP Policy must be with a NYS licensed and admitted carrier.

c. **Automobile Liability**
$1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

d. **Workers' Compensation and NYS Disability Insurance**
Statutory Workers' Compensation (C-105.2 or U-26.3); and NYS Disability Insurance (DB-120.1) for all employees [per NYS WC and Disability Laws]. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable.

A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

e. **Cyber**
The contractor must carry coverage applicable to first- and third-party claims, arising from a cyber incident that could impact the district's data the contractor may have in their possession. Limits shall be the greater of those carried by the Contractor or $250,000 per incident and $250,000 in the aggregate. If coverage is on a claims-made basis, coverage must have a retroactive date no later than the date of agreement with the BOCES and provide coverage for two years following the date of Final Completion of the Project. **The Cyber policy must be with a NYS licensed carrier.**

f. **Builder's Risk**
Must be purchased and maintained by the Owner of the property. The limit must reflect the total completed value (all material and labor costs) and provide coverage for fire, lightning, explosion, extended coverage, vandalism, malicious mischief, windstorm, hail and/or flood. Coverage will remain in effect until the project is completed and/or the property occupied and put to its intended use.

g. **Umbrella/Excess Insurance**
$5,000,000 each Occurrence and Aggregate for general construction and no work at elevation (1 story or 10 feet) and project values less than or equal to $1,000,000.
$10,000,000 each Occurrence and Aggregate for high-risk construction, work at elevation (>1 story or 10 feet) and project values greater than $1,000,000.
Umbrella/Excess coverage shall be on a follow-form basis or provide broader coverage over the General Liability and Auto Liability coverages.

6. **Subcontractors are subject to the same terms and conditions as stated above and must submit same to the BOCES for approval prior to the start of any work.**

7. Contractor acknowledges that failure to obtain such insurance on behalf of the BOCES constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the BOCES. The contractor is to provide the BOCES with a certificate of insurance, evidencing the above requirements have been met, prior to the commencement of work. The failure of

the BOCES to object to the contents of the certificate or the absence of same shall not be deemed a waiver of any rights held by the BOCES.

8. In the event the General Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the General Contractor shall indemnify, defend, and hold harmless the BOCES, its Board, employees and volunteers, and Construction Manager, and Architect from any and all claims for which the required insurance would have provided coverage**. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.**

ADDITIONAL REQUIREMENTS ASBESTOS, LEAD ABATEMENT AND/OR HAZARDOUS MATERIALS

Asbestos/Lead Abatement/Pollution Liability Insurance
$2,000,000 per occurrence/$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement, enclosure, encapsulation and/or 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. If a retroactive date is used, it shall pre-date the inception of the Contract.

If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall maintain pollution liability broadened coverage (ISO Endorsement CA 9948 or CA 01 12), as well as proof of MCS 90. Coverage shall fulfill all requirements of these specifications and shall extend for a period of three (3) years following acceptance by the OCES of the Certificate of Completion.

Testing Company Errors and Omission Insurance
$1,000,000 per occurrence/$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the BOCES.

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)

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

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

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

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

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

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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13 MISCELLANEOUS PROVISIONS

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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), as amended, and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. The Contract Documents include the Notice to Bidders (Advertisement), Instructions to Bidders, Supplemental Instructions to Bidders, Executed Bid Form (including Unit Prices) and all exhibits/addenda, Executed Non-Collusive Bidding Certification, and the Bidder's Response.

§ 1.1.1.1 The Contractor acknowledges and warrants that it has closely examined all the Contract Documents, that they are suitable and sufficient to enable the Contractor to undertake and complete the Work in a timely manner for the Contract Sum, and that they include all work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable statutes, codes, laws, ordinances, and regulations.

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and 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, 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 term "Work" also includes supervision, labor, equipment, tools, materials, supplies, incidental operations and activities required by the Contract Documents or reasonably inferable by Contractor therefrom as necessary to produce the results intended by the Contract Documents, in a safe, expeditious, orderly, and workmanlike manner, and in the best manner known to each respective trade.

§ 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.

§ 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,

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surveys, models, sketches, drawings, specifications, and other similar materials.

§ 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.

§ 1.2 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. In the event of inconsistencies within or between the parts of the Contract Documents, the Contractor shall (1) provide a better quality of Work or (2) comply with the more stringent requirements; either or both in accordance with the Architect's interpretation. The terms and conditions of the Subparagraph 1.2.1, however shall not relieve the Contractor of any of the obligations set forth elsewhere in this Agreement. All work shall conform to the Construction Documents. No significant change there from shall be made without prior written authorization by the Owner. Where only part of the Work is indicated, similar parts shall be considered repetition. When any detail is shown and the components therefore are fully described, similar details shall be construed and not mentioned in the other shall be of like effects as if shown or mention in both.

1. All dimensions shown on the Drawings are for bidding purposes only. It is the responsibility of the Contractor to verify all dimensions in the field to ensure proper and accurate fit of materials and items to be installed.
2. The lists of equipment, tabulations of data and schedules appearing in the Specifications or Drawings are included for assistance and guidance in arriving at a more complete understanding of the intended installation. They are not intended, or to be construed, as relieving the responsibility of the Contractor or any of the Prime Contractors in making their own takeoffs.
3. It is intended that all mechanical and electrical systems will be complete and in proper operation and that all construction components will be complete and in compliance with accepted construction practice upon completion of the Work. Even if items are missing from the plans and/or Specifications, but are normally required for proper operation of mechanical and electrical 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 in writing

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

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

1. It shall be the Contractor's responsibility, when subcontracting any portion of Work, to arrange or group items of work under particular trades to conform with prevailing customs of the trade, regardless of the particular Divisions and Sections of the Specifications in which the work id described.

§ 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 Within the Contract Documents for which each Prime Contractor is responsible, any Work included by reference in any section to another Specification's Section shall be included as Work under the Contract, whether or not it is called for under the Section referred to. Failure to cross-reference such items shall not relieve the Contractor or any Prime Contractor from the obligations to provide such work.

§ 1.2.4.1 If work is required in a manner to make it impossible to produce work of the quality required by or reasonably inferred from the Contract Documents, or should discrepancies appear among the Contract Documents, the Contractor

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shall immediately request in writing an interpretation from the Architect before proceeding with the work. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out work in the required manner or provide required guarantees, warranties, or bonds, and the Contractor shall not be entitled to any change in the Contract Sum or the Contract Time on account of such failure.

§ 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

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

§ 1.8 Building Information Models Use and Reliance

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

§ 1.9 Communication

§ 1.9.1 Construction Manager, Contractor and Architect shall meet periodically at mutually agreed upon intervals for the purpose of establishing procedures to facilitate cooperation, communication and timely responses among the participants. By participating in these meetings, the parties do not intend to create additional contractual obligations or modify the legal relationships which may already exist.

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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, other than Change Orders affecting the Contract Sum, and excepting those matters that New York State law vests the Board of Education with the power and duty to approve or authorize. Except as 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. The Contractor may not rely upon the direction of any employee of the Owner who has not been designed in writing by the Owner as the Owner's representative. The Owner shall not be responsible, financially or otherwise, for actions taken by the Contractor in reliance upon direction from unauthorized persons.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work, and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract.

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner, assisted by the Architect and/or Construction Manager, shall secure and pay for the building permit from the New York State Education Department . All other permits required from local agencies required for construction shall be paid for by the Contractor.

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

§ 2.3.3 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 furnish, upon written request and as necessary to complete the Work, surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work. The furnishing of such information by the Owner shall not relieve the Contractor from its duties under the Contract Documents, including those relating to inspection of the site.

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

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

§ 2.3.8 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.

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

§ 2.6 Acceleration Clause

§ 2.6.1 The Owner reserves the right to accelerate the Work of the Contract. In the event that the Owner directs acceleration, such directive will be only in written form. The Contractor shall keep cost and other project records related to the written acceleration directive separately from normal project costs and records and shall provide a written record of acceleration cost to the Owner on a daily basis.

§ 2.6.2 In order to recover additional costs due to a written acceleration directive, the Contractor must document that additional expenses were incurred and paid by the Contractor. Labor costs recoverable will be only overtime or shift premium costs or the cost of additional laborers brought to the site to accomplish the accelerated work effort. Equipment costs recoverable will be only the cost of added equipment mobilized to the site to accomplish the accelerated work effort.

§ 2.7 Owner's Right to Audit Contractor

§ 2.7.1 The Contractor and all subcontractors shall keep full, contemporaneous, and accurate records of all costs incurred and items billed in connection with the performance of the Work, which records shall be open to audit by the Owner or its authorized representatives during performance of the Work and until three years after Final Payment.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the 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.

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§ 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 carefully examined the Contract Documents and the site, and represents that the Contractor is thoroughly familiar with the nature and location of the Work, the 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 laws, statutes, ordinances, codes, rules and regulations , 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 local conditions and the Contract Documents are waived and will not be permitted.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.5, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents, without such notice to the Construction Manager and Architect, the Contractor shall assume responsibility for such performance and shall bear the attributable costs for correction.

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

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

§ 3.2.5 Where existing conditions are obscured or concealed from the Owner's or Architect's view prior to the start of this Project's construction activities, portrayal of such conditions in the documents is based on reasonable implications and assumptions. The Owner and Architect do not imply or guarantee to the Contractor in any way that such portrayals in the Documents are accurate or true.

§ 3.2.5.1 Physical investigations and testing of existing conditions will not be undertaken by the Architect, unless so indicated in the Contract Documents.

§ 3.2.5.2 The Contractor may submit written requests for information to the Architect to help facilitate the Contractor's performance of the Contract. Prior to submitting each request for information, 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.

§ 3.2.5.3 Each request for information shall be submitted to the Architect, in writing, with a copy to the Construction Manager. Each request for information shall identify the specific sources which were reviewed by the Contractor in an

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effort to determine the information requested, and a statement to the effect that the information being requested could not be determined from such sources.

§ 3.2.5.4 The Contractor shall submit each request for information sufficiently in advance of the date by which such information is requested in order to allow the Architect sufficient time, in the Architect's professional judgment, to permit adequate review and response and to permit Contractor compliance with the latest construction schedule.

§ 3.2.5.5. The Construction Manager shall maintain a log at the Project site that sequentially numbers and lists each request for information. This log shall contain the Drawings reference or Specification section to which the request pertains, the date of the request, to whom the request was made, by whom the request was made, the nature of the request, and the Architect's resolution thereof. This log shall be reviewed at each Project meeting and the status of the requests for information shall be made part of the Minutes of such meetings.

§ 3.2.5.6 The Contractor shall reimburse the Owner amounts charged to the Owner by the Architect or Construction Manager for responding to Contractor requests for information where such information is 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.

§ 3.3 Supervision and Construction Procedures

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

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

§ 3.3.3 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, and compliant with applicable laws, statutes, ordinances, codes, rules and regulations. The inspection of any portion of the Work by the Architect or Owner's representative shall not relieve Contractor of the responsibility described in this section 3.3.3.

§ 3.4 Labor and Materials

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

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

§ 3.4.2.1 After the Contract has been executed, the Architect in conjunction with the Construction Manager, will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements. Substitutions shall satisfy the following conditions:

1. The materials, products and equipment described in the Contract Documents establish the standard of required quality, function, dimension and appearance expected.

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2. Requests for substitutions must be submitted at the time that bids are received.
3. Substitution requests will be considered only if standards are met or exceeded as described above and are subsequently approved in writing by the Architect and Owner.
4. Each such request shall include the name of the material, product or equipment item for which substitution is requested and a complete description of the proposed substitute, including drawings, cuts, performance and test data and any other information necessary for a complete evaluation.
5. Each such request shall include a statement setting forth any changes in other materials, products or equipment or other work that incorporation of the substitution would require.
6. The burden of proof of the merit of the proposed substitution is upon the proposer.
7. The Architect's decision of approval or disapproval of a proposed substitution shall be final and will be set forth in writing.
8. Additional substitution requests, during construction, will be considered only if substitution is caused by specific material, product or equipment's subsequent removal from, or unavailability in the market place and only at "no change" or "credit" to Contract amount.
9. Contractor's Responsibilities: If any of the following conditions occur due to substitutions, the contractor making the substitution shall bear the cost of such conditions, including payment for services rendered by the Architect:
    a. Redesign required for any of the Work;
    b. Material or quantity changes for any of the Work.
    c. Delays in any of the Work.
    d. Request for information generated due to substitutions.

§ 3.4.2.2 By making requests for substitutions, the Contractor:

1. Represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
2. Represents that it will provide the same or greater warranty for the substitution as it would have provided for the product specified;
3. Certifies that the cost data presented is complete and includes all related costs for the substituted products and for Work that must be changed as a result of the substitution, waives all claims for additional costs related to the substitution, and agrees to the conditions set forth in § 3.4.2.1 through .9 above; and
4. Shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

§ 3.4.2.3 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions for convenience and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

§ 3.4.4 The Contractor, as indicated in the Instructions to Bidders, shall furnish in writing to the Owner through the Construction Manager a list showing the name of the manufacturer proposed to be used for equivalents of products identified in the Specifications, and where applicable, the name of the installing subcontractor. By identifying and submitting a proposed manufacturer and/or installer the contractor warrants that products furnished and/or installed by them conform to such requirements of the Contract Documents. The Construction Manager, in conjunction with the Architect, will reply with reasonable promptness to the Contractor in writing stating whether or not the Owner, Construction Manager and/or Architect, after due investigation, have reasonable objection to any such proposed manufacturer or installer.

1. If adequate data on a proposed equivalent manufacturer or installer is not available, the Architect may state that the action will be deferred until the Contractor provides additional data.
2. Failure of the Owner, Construction Manager or Architect to object to a manufacturer or installer shall not constitute a waiver of the requirements of the Contract Documents.
3. Products furnished by the listed manufacturer or installed by the listed installer shall conform to such requirements of the Contract Documents.

§ 3.4.5 The Contractor shall comply with the most current Contract Requirements and Prevailing Wage Rate Schedules as published by the Bureau of Public Works, State of New York, Department of Labor established for this Project.

§ 3.4.6 No materials or supplies for the Work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale or other agreement by which an interest is retained by the seller. The

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Contractor warrants that he has full title to all materials and supplies used by him in the Work, or resold to the Owner, pursuant to this Contract Document, free from all liens, claims or encumbrances.

§ 3.4.7 All materials used permanently in the Work shall be new unless otherwise specified. The apparent silence of the Specifications as to any detail described concerning any Work to be done and materials to be furnished shall be regarded as meaning that the best general practice is to prevail and that only materials and workmanship of the first quality are to be used, and all interpretations of the Specifications shall be made on this basis. All material incorporated in the Project Work shall be clean and exhibit no appearance of aging, exposure to weather, prior use, handling or damage of any kind.

§ 3.4.8 Manufacturer's identifications shall be inconspicuous, but where nameplates contain information relative to characteristics or maintenance, they shall be clearly visible and located for easy access.

§ 3.4.9 Equipment intended for permanent installation shall not be operated for temporary purposes without the written permission of the Architect.

§ 3.4.10 Materials shall be delivered in manufacturer's original sealed containers, with complete identification of contents and manufacturer, and kept sealed in original containers until used. Labels shall not be removed until materials have been installed and inspected.

§ 3.4.11 Whenever the Contract Documents require delivery by the Contractor of any materials, equipment or other items, the term delivery shall be deemed to include unloading and storing with proper protection where directed.

§ 3.4.12 Materials shall be applied or installed under proper climactic conditions, not where they may be affected by temperature, moisture, humidity or dust.

§ 3.4.13 As defined by Federal and State Laws, no materials incorporated into the Project Work shall contain asbestos. Material shall be "asbestos-free" containing zero percent (0%) asbestos. The Architect reserves the right to request certification from the material manufacturer through the Contractor for certification that materials installed contain zero percent (0%) asbestos.

§ 3.4.14 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.

A sufficient force of competent experienced workman, foreman and superintendents shall be employed at all times to permit the Work to be pursued with diligence until completion.

§ 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. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work 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.

§ 3.6.1 Exempt from Sales Tax: New York State Sales Tax is not applicable to any materials and supplies to be incorporated into Work under the terms of the Contract, the Owner being exempt therefrom. There is no exemption from the sales or use tax on charges to the Contractor or subcontractor for lease of tools, machinery, equipment or other

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property used in conjunction with the Project. The Contractors and subcontractors shall be solely responsible for and pay any and all applicable taxes, including sales and compensating use taxes, on such leased tools, machinery, equipment or other property, and for materials not incorporated in the Project and the amount of such taxes, if any, shall be deemed included in executed Base Bid.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

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

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor fails to give such notices as applicable to the performance of the Work, the Contractor shall be liable for and shall indemnify and hold harmless the Owner against any and all resulting fines, penalties, judgements or damages, including reasonable attorney fees imposed on or incurred by the parties indemnified, as a result of such failures by the Contractor.

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

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect and 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 that an equitable adjustment be made 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, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, 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

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the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ and designate a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. The superintendent shall be in attendance at the Project site full time throughout the work, including completion of the punch list.

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information, and the Construction Manager's use in developing the Project schedule, a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Contractors, or the construction or operations of the Owner's own forces or Separate Contractors.

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

§ 3.10.3 The Contractor shall participate with other Contractors, the Construction Manager, and the Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

§ 3.10.4 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager, and Architect, and incorporated into the approved Project schedule.

§ 3.11 Documents and Samples at the Site

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

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§ 3.12 Shop Drawings, Product Data, and Samples

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect 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.

§ 3.12.5 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.

§ 3.12.6 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.

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

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specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner, the Architect, and the Construction Manager 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. The Construction Manager shall review submittals for sequencing, constructability, and coordination impacts on other Contractors.

§ 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.

§ 3.13 Use of Site

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

§ 3.13.2 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 be responsible for enforcing the Owner's security and access policies and procedures and the following rules of conduct for its personnel and those of its subcontractors, sub-subcontractors, and suppliers at the Project site, and the Owner's Project Representative shall provide interpretations should a question arise if the rules of conduct are being adequately enforced by the Contractor:

.1 No smoking, vaping or use of tobacco products.
.2 No drinking of alcoholic beverages or use of controlled substances.
.3 No working, or presence on site, under the influence of alcoholic beverages or controlled substances.
.4 No use of indecent language or display of indecent images, publications or terms.
.5 No use of radios or other entertainment devices.
.6 No horseplay or dangerous behavior.
.7 No firearms or other weapons.
.8 **No communications with staff or students.**

§ 3.13.4 The Contractor shall require its personnel and those of its Subcontractors, Sub-subcontractors and suppliers to wear visible photo-identification badges acceptable to the Owner, at all times for identification and security purposes.

§ 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.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste

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materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, 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 the Contractor has reason to believe that the required design, process, or product is an infringement of a copyright or a patent, 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 indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused in whole or in part by the acts, omissions, fault, breach of contract, breach of warranty or statutory or regulatory violation of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT 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.

§ 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, Architect, and Contractor. 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. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to

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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 from the most recent Project schedule prepared by the Construction Manager and defects and deficiencies observed in the Work.

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

§ 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.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, 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. The Owner shall communicate with the Contractor and the Construction Manager's consultants through the Construction Manager about matters arising out of or relating to the Contract Documents. The Owner and Construction Manager shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Construction Manager otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with other Contractors shall be through the Construction Manager. Communications by and with the Owner's own forces and Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 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.

§ 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. The Construction Manager shall determine in general whether the Work of the Contractor is being performed in accordance with the requirements of the Contract Documents and notify the Owner, Contractor and Architect of defects and deficiencies in the Work. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, upon written authorization of the Owner, whether or not the 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, 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

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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 Construction Manager and 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 Construction Manager and 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 Construction Manager and Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.13 The Construction Manager in coordination with the Architect will prepare Change Orders and Construction Change Directives.

§ 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 date or 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 Owner shall notify the Construction Manager of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 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.

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§ 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, will not show partiality to either, and will not be liable for results of interpretations or decisions so rendered in good faith.

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

§ 4.2.21 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, through 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.

§ 4.2.21.1 The Architect's response to a request for information ("RFI") or issuance of a clarification or interpretation shall be considered an interpretation, clarification, supplemental information or an order for a minor change in the Work not involving an adjustment in Contract Sum nor extension of Contract Time and not inconsistent with the intent of the Contract Documents, and shall be binding, unless indicated otherwise in the Architect's response to the RFI.

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.

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

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, 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 or Architect has no reasonable 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 Contractor shall, prior to work being performed, obtain and provide to the Owner and Construction Manager, a copy of the Subcontractor's Contractor Certificate of Registration filed with the New York State Department of Labor.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be

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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 but not limited to the responsibility for safety of the Subcontractor's Work, and obligations to defend and indemnify the Contractor, by these Contract 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 Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.1 Without limitation on the generality of Section 5.3, each Subcontractor agreement and each Sub-subcontractor agreement shall include, and shall be deemed to include, a provision that the Owner and its authorized representatives shall have the right to conduct audits or other examinations of the Subcontractor's (or Sub-subcontractor's) books and records relating to Claims and any Change Orders in which the price is determined on the basis of actual costs incurred.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; 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 Subcontractor agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, provided that the Owner shall not be under any obligation to compensate the Subcontractor with respect to amounts that the Owner has already paid to the Contractor for such Subcontractor's work.

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

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

§ 5.5 Owner Payments to Subcontractors

§ 5.5.1 In the event of any default hereunder by the Contractor, or in the event the Owner or Architect does not approve any Application for Payment that is not the fault of a Subcontractor, the Owner may make direct payment to the Subcontractor, less appropriate retainage. In that event, the amount so paid to the Subcontractor shall be deducted from the payment to the Contractor.

§ 5.5.2 Nothing contained herein shall create any obligation on the part of the Owner to make any payments to any Subcontractor, and no payment by the Owner to any Subcontractor shall create any obligation to make any further payments to any Subcontractor.

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. If the Contractor claims that delay or additional cost is involved because of such action by

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the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager, 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.

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner'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 in writing and in detail 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, except as to defects not then reasonably discoverable.

§ 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. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces, Separate Contractors, or other Contractors.

§ 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.

§ 6.3 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, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, 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. An order for a minor change in the Work may be issued by the Architect alone.

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

§ 7.2 Change Orders

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
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager in coordination with the Architect 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.

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the 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 7.3.3.3, 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 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Construction Manager and Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

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

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

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

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effective immediately and shall be recorded as a Change Order.

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

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The 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.

§ 7.4 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.

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner, Architect, Construction Manager, or an employee of any of them, or of the Owner's own forces, Separate Contractors, or other Contractors; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute

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resolution; or (5) by other causes that the Contractor asserts and the Architect, based on the recommendation of the Construction Manager, determines justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine. In the event that the Owner, the Contractor or the Architect is delayed or hindered in or prevented from the performance of any act required by the Contract Documents by reason of a labor dispute, fire, failure of power, unusual delay in deliveries, adverse weather conditions not reasonably anticipatable, unavoidable casualties or other causes of a like nature beyond the Owner's, the Contractor's or the Architect's control, the Contactor (or its Subcontractors) shall not be entitled to any additional compensation. Extensions of time must be requested by the Contractor in writing and shall only be considered after the Contractor has made reasonable efforts, at no cost to the Owner, to recover the lost time.

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

§ 8.3.3 The Owner shall not be liable to the Contractor and/or any Subcontractor for claims or damages of any nature caused by or arising out of delays. The sole remedy against the Owner for 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; 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 review of shop drawing and requests for instruction(s); or, on account of any delay, obstruction or hindrance for any cause whatsoever by the Owner, Construction Manager, Architect, or any other contractor on the project, whether or not foreseeable or anticipated. **IT IS EMPHASIZED THAT NO MONETARY RECOVERY MAY BE OBTAINED BY THE CONTRACTOR FOR DELAY AGAINST THE OWNER, CONSTRUCTION MANAGER, OR ARCHITECT BASED ON ANY REASON AND THAT THE CONTRACTOR'S SOLE REMEDY, IF APPROPRIATE, IS ADDITIONAL TIME.**

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

§ 9.3.1.3 Applications for Payment must be accompanied by any and all releases of liens for previous applications from Contractor and their Subcontractors and a sworn and notarized statement that all Subcontractors have been paid at least 95% of previously requisitioned sums.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work, provided the Owner has authorized such delivery and storage of materials at the site in advance. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. The Owner reserves the right to limit payment to materials that are in short and/or critical supply and materials specifically fabricated for the project. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site. The Owner shall have the right, at any time on reasonable notice, to inspect materials and equipment which have been stored off site in accordance with this section.

§ 9.3.2.1 Proof of insurance for items stored off site and copies of invoices are to be provided with Applications for Payment requesting payment for stored materials.

§ 9.3.2.2 Procedures required by Owner shall include, but are not necessarily limited to, submission by the Contractor to the Architect of bills of sale and bills of lading for such materials and equipment, provision of opportunity for 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.

§ 9.3.2.3 All such materials and equipment, including materials and equipment stored on-site but not yet incorporated in 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, 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, suppliers, or other persons or entities that provided labor, materials and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 Where there is only one Contractor, the Construction Manager will, within seven 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 days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Certificate for Payment, in the full amount of the Application for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a 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 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 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 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 application with information from similar applications for progress payments from the other Contractors; (3) prepare a

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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 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 or, in the case of more than one Contractor, a Project Application and Certificate for Payment, shall be based upon the Construction Manager's evaluation of the Work and the data in the Application or Applications 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, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment or, in the case of more than one Contractor, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and data in the Application for Payment or Project 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, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, 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 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 construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project 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 9.4.3 and 9.4.4 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 and 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project 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, may nullify the whole or a part of a Certificate for Payment or Project 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 or a Separate Contractor or other Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.
.8 any other reasonable grounds for objection or withholding as provided in the Contract or as permitted by law.

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

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld. The Owner shall not be deemed in default by reason of withholding payments while any condition described in 9.5.1 remains.

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager, and both will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

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

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

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

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

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

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

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier.

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Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.8 Substantial Completion

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

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

§ 9.8.3 Upon receipt of the 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 list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect and Construction Manager for any additional on-site observations.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work of all of the Contractors, 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 items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor 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.

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a 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 shall perform an inspection to confirm the completion of Work of the Contractor. The Construction Manager shall make recommendations to the Architect when the Work of all of the Contractors is ready for final inspection, and shall then forward the Contractors' notices and Application for Payment or Project Application for Payment, 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 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. The Architect will perform no more than two (2) on-site inspections to determine whether the Work or a designated portion thereof has attained final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional on-site inspection, and may deduct from the Contract Sum amounts paid to the Architect for any additional inspection necessitated by the Contractor's misrepresentation of final completion.

§ 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) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the 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 shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

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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.

§ 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 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. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner, 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.

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

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

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written 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 regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner, Construction Manager and Architect of the condition.

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Construction Manager and Construction Manager's consultants, and the Architect and Architect's consultants, shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

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

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of

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obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

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

§ 11.1.5 The Contract Documents shall also include, and are hereby amended to incorporate by reference, the insurance requirements promulgated by the New York Schools Insurance Reciprocal (NYSIR) applicable to capital construction projects (the 'NYSIR Capital Project Insurance Requirements'), as set forth in the Rider to AIA Document A132-2019, Exhibit A. In the event of a conflict between any provision of the Contract Documents and the NYSIR Capital Project Insurance Requirements, the more stringent provision or broader protection in favor of the Owner shall apply.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Construction Manager and Construction Manager's consultants; (3) the Architect and Architect's consultants; (4) other Contractors and any of their subcontractors, sub-subcontractors, agents, and employees; and (5) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, other Contractors, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

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

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

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss.

§ 11.5 Adjustment and Settlement of Insured Loss

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

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the 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 that the Construction Manager or Architect has not specifically requested to examine 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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion, and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the 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 one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, Construction Manager or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be

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enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located excluding that jurisdiction's choice of law rules. The parties 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 located in Rockland County, New York.

§ 13.1.1 Contractor Registration Requirements

1. In compliance with section 220-i of the NY Labor Law, the Contractor must be registered with the New York State Department of Labor (DOL) before bidding on the Project.

2. The Contractor is required to submit a valid DOL certificate of registration with any bid.

3. The Contractor must ensure that any Subcontractor is registered with DOL prior to such Subcontractors commencing any work on the Project.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

§ 13.4.2 If the 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

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Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the 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 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.

§ 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.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents, which are not disputed by the Owner, shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.6 Severability

§ 13.6.1 Should any provision of the Contract be finally determined by any court of competent jurisdiction to be invalid or unenforceable for any reason, the invalidity or unenforceability of such provision shall not affect the validity of the remaining provisions of the Contract, unless such invalidity or unenforceability would defeat an essential purpose of the Contract, in which case, the Contract shall be terminated.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped; 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 on a Certificate for Payment within the time stated in the Contract Documents.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon thirty (30) days' written notice to the Owner, Construction Manager and Architect, with reasonable opportunity to cure, terminate the

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Contract and recover from the Owner payment for Work executed.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise breaches a material provision of the Contract Documents or breaches any warranty made by the Contractor under or pursuant to the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, after consultation with the Construction Manager, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work. . The costs of finishing the Work include, without limitations, all reasonable attorneys' fees incurred by the Owner, additional Architect/Engineering and Construction Manager costs, insurance, additional interest because of any delay in completing the Work, and all other direct and indirect and consequential damages incurred by the Owner by reason of the termination of the Contractor stated herein.

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, and other damages incurred by the Owner (including reasonable attorneys' fees) and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, 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.

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to, and the Owner shall reimburse the Contractor for, an equitable portion of the Contractor's fee based on the portion of the Work properly completed before the effective date of termination. 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. Contractor shall be entitled to no other payment and waives any claim for damages

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

§ 15.1.3.3 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 Clear statement of claim matter, including background and chronology.

.2 Documentation in support of claim matter.

.3 Documentation in support of claimed damages.

.4 Certification by responsible officer of claimant.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments on non-disputed items in accordance with the Contract Documents. **15.1.4.2** The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost. If the Contractor wishes to make a Claim for an increase in the Contract Sum, written

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

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. The Contractor shall accompany the Claim with a written analysis with a proposed revisions to the Schedule illustrating the claimed influence of the basis for delay on the critical path of the Work and the applicable deadlines that may be impacted. Contractor will exercise reasonable efforts to mitigate the potential impact of any delay but shall be compensated for any costs associated therewith. In the case of a continuing delay only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction. The time for performance of the Contract, as set forth in the Construction Schedule shall include an allowance for delays due to reasonably anticipated adverse weather for the area where the Work is located. For the purpose of establishing that abnormal adverse weather conditions have caused a delay, and determining the extent of delay, attributed to such weather conditions the Contractor shall furnish with its claim. National Oceanic and Atmospheric Administration (NOAA) National Weather Services records of climatic conditions during the same time interval for the previous five (5) years for the locality of the Work; the Contractor's daily job site logs/daily construction reports showing weather, job activities, and the effect of weather on the progress of the Work; and an impact schedule showing the effects of the weather event on the critical path of the Contractor's Construction Schedule. Time extension for weather delays and related impact do not entitle the Contractor to extended overhead recovery or to any other monetary compensation associated with the claim unless approved in writing by the Owner.

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

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

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

§ 15.2 Initial Decision

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

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

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

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

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

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

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

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

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

§ 15.3 Mediation

§ 15.3.2 The parties may endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation.

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

§ 15.4 Arbitration

§ 15.4.1 The parties expressly agree to delete the requirement that any and all controversies and claims arising out of the Contract be referred to arbitration. By so agreeing, the parties express their mutual intent that there is no agreement to arbitrate such disputes, notwithstanding the use and reference to arbitration elsewhere in the Contract Documents.

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INSURANCE REQUIREMENTS – CAPITAL CONSTRUCTION

1. Notwithstanding any terms, conditions or provisions, in any other writing between the parties, the contractor hereby agrees to effectuate the naming of the Owner as an Additional Insured on the contractor's insurance policies, except for workers' compensation and N.Y. State Disability insurance.

2. The policy naming the Owner as an Additional Insured shall:

   a. Be an insurance policy from an A.M. Best A- rated or better insurer, **licensed and admitted** to conduct business in New York State. A New York licensed and admitted insurer is **required.**

   b. State that the organization's coverage shall be primary and non-contributory coverage for the Owner, its Board, employees and volunteers including a waiver of subrogation in favor of the Owner for all coverages including Workers Compensation.

   c. Additional insured status for General Liability coverage shall be provided by standard or other endorsements that extend coverage to the Owner for on- going operations (CG 20 38 or equivalent) and products and completed operations (CG 20 37 or equivalent). The decision to accept an endorsement rests solely with the BOCES. A completed copy of the endorsements must be attached to the Certificate of Insurance to include General Liability, Auto Liability and Umbrella/Excess coverages. A copy of the Acord 855 Form is required to be sent for review.

3. a. The certificate of insurance must describe **all services** provided by the contractor (e.g., roofing, carpentry or plumbing) that are covered by the liability policies.

   b. At the Owner's request, the Contractor shall provide a copy of the declaration page of the liability and umbrella/excess policies with a list of endorsements and forms. If requested, the contractor will provide a copy of the policy endorsements and forms.

   c. There will be no coverage restrictions and/or exclusions involving New York State Labor Law statutes or gravity related injuries.

   d. No policies containing escape clauses or exclusions contrary to the Owner's interests will be accepted.

   e. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACORD 855 2014/15) must be included with the certificates of insurance. For any "Yes" answers on Items G through L on this Form– additional details must be provided in writing. Policy exclusions may not be accepted.

4. The contractor agrees to indemnify the Owner for applicable deductibles and self- insured

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retentions.

5. Minimum Required Insurance:

a. **Commercial General Liability Insurance**
$1,000,000 per Occurrence/$2,000,000 Aggregate
$2,000,000 Products and Completed Operations
$1,000,000 Personal and Advertising Injury
$100,000 Fire Damage
$10,000 Medical Expense
The general aggregate shall apply on a per-project basis. Products and completed operations coverage must remain in effect for **three years** after project completion and acceptance of the work performed.

b. Owners Contractors Protective (OCP) Insurance
For projects less than or equal to $1,000,000 and/or work on 1 story (10 feet) only.

$1,000,000 per occurrence, $2,000,000 aggregate with the Owner as the Named Insured. There will be no Additional Insureds on any OCP Policies.

For projects greater than $1,000,000 and/or work over 1 story (10 feet); $2,000,000 per occurrence, $4,000,000 aggregate with the Owner as the Named Insured. There will be no Additional Insureds on any OCP Policies.

The OCP Policy must be with a NYS licensed and admitted carrier.

c. **Automobile Liability**
$1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

d. Workers' Compensation and NYS Disability Insurance
Statutory Workers' Compensation (C-105.2 or U-26.3); and NYS Disability Insurance (DB-120.1) for all employees [per NYS WC and Disability Laws]. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable.

A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

a. Cyber
The contractor must carry coverage applicable to first- and third-party claims, arising from a cyber incident that could impact the district's data the contractor may have in their possession. Limits shall be the greater of those carried by the Contractor or $250,000 per incident and $250,000 in the aggregate. If coverage is on a claims-made basis, coverage must have a retroactive date no later than the date of agreement with the Owner and provide coverage for two years following the date of Final Completion of the Project. **The Cyber policy must be with a NYS licensed carrier.**

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b. Builder's Risk

Must be purchased and maintained by the Owner of the property. The limit must reflect the total completed value (all material and labor costs) and provide coverage for fire, lightning, explosion, extended coverage, vandalism, malicious mischief, windstorm, hail and/or flood. Coverage will remain in effect until the project is completed and/or the property occupied and put to its intended use.

c. Umbrella/Excess Insurance

$5,000,000 each Occurrence and Aggregate for general construction and no work at elevation (1 story or 10 feet) and project values less than or equal to $1,000,000.

$10,000,000 each Occurrence and Aggregate for high-risk construction, work at elevation (>1 story or 10 feet) and project values greater than $1,000,000.

Umbrella/Excess coverage shall be on a follow-form basis or provide broader coverage over the General Liability and Auto Liability coverages.

6. Subcontractors are subject to the same terms and conditions as stated above and must submit same to the Owner for approval prior to the start of any work.

7. Contractor acknowledges that failure to obtain such insurance on behalf of the Owner constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the Owner. The contractor is to provide the Owner with a certificate of insurance, evidencing the above requirements have been met, prior to the commencement of work. The failure of the Owner to object to the contents of the certificate or the absence of same shall not be deemed a waiver of any rights held by the Owner.

8. In the event the General Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the General Contractor shall indemnify, defend, and hold harmless the Owner, its Board, employees and volunteers from any and all claims for which the required insurance would have provided coverage. **This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.**

ADDITIONAL REQUIREMENTS ASBESTOS, LEAD ABATEMENT AND/OR HAZARDOUS MATERIALS

Asbestos/Lead Abatement/Pollution Liability Insurance

$2,000,000 per occurrence/$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement, enclosure, encapsulation and/or 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. If a retroactive date is used, it shall pre-date the inception of the Contract.

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If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall maintain pollution liability broadened coverage (ISO Endorsement CA 9948 or CA 01 12), as well as proof of MCS 90. Coverage shall fulfill all requirements of these specifications and shall extend for a period of three (3) years following acceptance by the Owner of the Certificate of Completion.

Testing Company Errors and Omission Insurance

$1,000,000 per occurrence/$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the Owner.



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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 ☐

PERIOD TO:

CONTRACT DATE:

PROJECT NOS: / /

FROM CONTRACTOR:

VIA CONSTRUCTION MANAGER:

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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DRAFT

AIA® Document G703® – 1992

Continuation Sheet

AIA Document G702®, Application and Certification 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:	001
APPLICATION DATE:	
PERIOD TO:	
ARCHITECT'S PROJECT NO:	

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED 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)
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00%**	**$0.00**	**$0.00**

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DRAFT AIA® Document G701/CMa™ - 1992

Change Order - Construction Manager-Adviser Edition

PROJECT *(Name and address):*

CHANGE ORDER NUMBER: 001
INITIATION DATE:

OWNER: ☐
CONSTRUCTION MANAGER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

TO CONTRACTOR *(Name and address):*

PROJECT NUMBERS: /
CONTRACT DATE:
CONTRACT FOR:

THE CONTRACT IS CHANGED AS FOLLOWS:

The original Contract Sum was	$	0.00
Net change by previously authorized Change Orders	$	0.00
The Contract Sum prior to this Change Order was	$	0.00
The Contract Sum will be increased by this Change Order in the amount of	$	0.00
The new Contract Sum including this Change Order will be	$	0.00

The Contract Time will be increased by Zero (0) days.
The date of Substantial Completion as of the date of this Change Order therefore is .

NOTE: This summary does not reflect changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE OWNER, CONSTRUCTION MANAGER, ARCHITECT AND CONTRACTOR.

CONSTRUCTION MANAGER *(Firm name)*	**ARCHITECT** *(Firm name)*
ADDRESS	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*
(Typed name) **DATE:**	*(Typed name)* **DATE:**
CONTRACTOR *(Firm name)*	**OWNER** *(Firm name)*
ADDRESS	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*
(Typed name) **DATE:**	*(Typed name)* **DATE:**

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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:**	OWNER: ☐ ARCHITECT: ☐
	CONTRACT FOR:	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	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, 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:

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AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR:	
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	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:

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AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
		CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	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)

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DRAFT AIA® Document G709™ – 2001

Work Changes Proposal Request

PROJECT *(Name and address)*:

PROPOSAL REQUEST NUMBER: 001

DATE OF ISSUANCE:

CONTRACT FOR:

CONTRACT DATE:

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐
ARCHITECT: ☐
CONSULTANT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

OWNER *(Name and address)*:

FROM ARCHITECT *(Name and address)*:

TO CONTRACTOR *(Name and address)*:

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Within Zero (0) days, the Contractor must submit this proposal or notify the Architect, in writing, of the date on which proposal submission is anticipated.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

DESCRIPTION *(Insert a written description of the Work)*:

ATTACHMENTS *(List attached documents that support description)*:

REQUESTED BY THE ARCHITECT:

_____ _____

(Signature) *(Printed name and title)*

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DRAFT AIA® Document G710™ – 1992

Architect's Supplemental Instructions

PROJECT *(Name and address)*:

ARCHITECT'S SUPPLEMENTAL INSTRUCTION NO: 001

OWNER: ☐
ARCHITECT: ☐
CONSULTANT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

OWNER *(Name and address)*:

DATE OF ISSUANCE:

CONTRACT FOR:

CONTRACT DATE:

FROM ARCHITECT *(Name and address)*:

TO CONTRACTOR *(Name and address)*:

ARCHITECT'S PROJECT NUMBER:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

DESCRIPTION:

ATTACHMENTS:
(Here insert listing of documents that support description.)

ISSUED BY THE ARCHITECT:

_____ _____
(Signature) *(Printed name and title)*

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DRAFT AIA® Document G714/CMa™ – 1992

Construction Change Directive Construction Manager-Adviser Edition

PROJECT: *(Name and address)*	**DIRECTIVE NUMBER:** 001 **DATE:** **CONTRACT FOR:**	OWNER: ☐ ARCHITECT: ☐ CONSTRUCTION MANAGER: ☐
TO CONTRACTOR: *(Name and address)*	**CONTRACT DATED:** **PROJECT NUMBERS:** /	CONTRACTOR: ☐ FIELD: ☐ OTHER: ☐

You are hereby directed to make the following change(s) in this Contract:

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

- ☒ Lump Sum increase of $0.00
- ☐ Unit Price of $ per
- ☐ as provided in Section 7.3.6 of AIA Document A201/CMa–1992.
- ☐ as provided in Section 7.3.7 of AIA Document A232–2009.
- ☐ as follows:

2. The Contract Time is proposed to (remain unchanged). The proposed adjustment, if any, is 0 days.

Signature by the Contractor indicates the Contractor's agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Construction Change Directive.
CONTRACTOR *(Firm name)*
ADDRESS
BY *(Signature)*
(Typed name)
DATE:

When signed by the Owner, Construction Manager and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

OWNER *(Firm name)*	**CONSTRUCTION MANAGER** *(Firm name)*	**ARCHITECT** *(Firm name)*
ADDRESS	**ADDRESS**	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*	**BY** *(Signature)*
(Typed name)	*(Typed name)*	*(Typed name)*
DATE	**DATE**	**DATE**

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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)

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:

(Any additional signatures appear on the last page of this Payment Bond.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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

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

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

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User Notes: (640e2aedf442e4498d0967ee)

§ 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.

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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.

§ 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.

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§ 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:

.1 Surety further agrees that in the 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 the 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 Owner.

.2 Surety agrees that it is obligated under the bonds to any successor, grantee or assignee of the Owner.

.3 Each material or equipment supplier or subcontractor shall provide a partial release of liens every 60 days or as otherwise agreed upon between Owner and Contractor.

(Any additional signatures appear on the last page of this Payment Bond)

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Performance Bond

CONTRACTOR:
(Name, legal status and address)

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

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:

(Any additional signatures appear on the last page of this Performance Bond.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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

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

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

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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.

§ 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

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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.

§ 16 Modifications to this bond are as follows:

.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.

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.2 Surety further agrees that in the 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 the 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 Owner.

.3 Surety agrees that it is obligated under the bonds to any successor, grantee or assignee of the Owner.

(Any additional signatures appear on the last page of this Performance Bond)

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

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SECTION 00 9000 - RESCUE REGULATIONS

PART 1 - GENERAL

1.1 NYSSED RESCUE REGULATIONS - Uniform Safety Standards for School Construction and Maintenance Projects

A. These regulations are the responsibility of the General Contractor and his/her subcontractor(s)

1. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

2. All building areas to be disturbed during this construction project have been tested for lead and asbestos. All pertinent information has been included in this project specification and/or in the drawings

3. General safety and security standards for construction projects.

a. All construction materials shall be stored in a safe and secure manner.

b. Fences around construction supplies or debris shall be maintained.

c. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.

d. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.

e. Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites.

4. Separation of construction areas from occupied spaces. Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. 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.

a. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

b. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

c. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session

5. The General Contractor shall develop a plan detailing how exiting required by the applicable building code will be maintained throughout the duration of the construction project. Refer to Summary of Work for scheduling and phasing. Provide site logistics plan indicating temporary partitions separating areas of work from the rest of the school building. Temporary partitions affecting building egress and exiting shall be submitted to the architect for review and approval.

6. The prime contractor shall develop a plan detailing how adequate ventilation will be maintained throughout the duration of the construction project.

7. Construction and maintenance operations shall not produce noise in excess of 60 dBA in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken.

8. The contractor shall be responsible for the control of chemical fumes, gases, and other contaminates produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure they do not enter occupied portions of the building or air intakes.

9. The contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers recommendations before a space can be occupied.

10. Large and small asbestos abatement projects as defined by 12NYCRR56 shall not be performed while the building is occupied". Note, It is our interpretation that the term "building", as referenced in this section, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier.

11. Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required and complete isolation of ventilation systems and at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.

12. All areas scheduled for work have been examined for lead-containing materials. Results of these tests are available by contacting The School District, Barbara Briganti, Director of Business Administration, at 914.669.5414. No work of this contract anticipates disturbance to any surrounding materials that may have been identified as “lead-containing”.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00 9000

SECTION 00 90 01 - NY SED REGULATIONS 155.5

PART 1 - GENERAL

1.1 NYSSED 155.5 REGULATIONS - Uniform Safety Standards for School Construction and Maintenance Projects

A. These regulations are the responsibility of each contractor and his/her subcontractor(s)

PART 2 - Section 155.5 Uniform Safety Standards for School Construction and Maintenance Projects

PART 3 - (a) Monitoring of construction and maintenance activities.

PART 4 - The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy and shall be monitored during construction or maintenance activities for safety violations by school district personnel. It is the responsibility of the board of education or board of cooperative educational services to assure that these standards are continuously maintained when the building or any portion thereof is occupied.

PART 5 - (b) Investigation and disposition of complaints relating to health and safety received as a result of construction and maintenance activities.

PART 6 - Boards of education and boards of cooperative educational services shall follow procedures established under section 155.4(d)(7) of this Part.(c) Pre-construction testing and planning for construction projects.

PART 7 - (1) Boards of education and boards of cooperative educational services shall assure that proper planning is made for safety of building occupants during construction. For all construction projects for which bids are issued on or after September 30, 1999, such boards shall assure that safety is addressed in the bid specifications and contract documents before contract documents are advertised for bid. All school areas to be disturbed during renovation or demolition shall be tested for lead and asbestos. Appropriate procedures to protect the health of building occupants shall be included in the final construction documents for bidding.

PART 8 - (2) Boards of education and boards of cooperative educational services shall establish procedures for involvement of the health and safety committee to monitor safety during school construction projects. The health and safety committees in school districts other than in cities with one million inhabitants or more shall be expanded during construction projects to include the project architect, construction manager, and the contractors. Such committee shall meet periodically to review issues and address complaints related to health and safety resulting from the construction project. In the case of a city school district in a city of one million inhabitants or more, the board of education shall submit

procedures for protecting health and safety during construction to the commissioner for approval. Such procedures shall outline methods for compliance with this section.

PART 9 - (3) The district emergency management plan shall be updated to reflect any changes necessary to accommodate the construction process, including an updated emergency exit plan indicating temporary exits required due to construction. Provisions shall be made for the emergency evacuation and relocation or release of students and staff in the event of a construction incident.

PART 10 - (4) Fire drills shall be held to familiarize students and staff with temporary exits and revised emergency procedures whenever such temporary exits and revised emergency procedures are required.

PART 11 - (d) Pre-construction notification of construction projects.

PART 12 - The board of education or board of cooperative educational services shall establish procedures for notification of parents, staff and the community in advance of a construction project of $10,000 or more to be conducted in a school building while the building is occupied. Such procedures shall provide notice at least two months prior to the date on which construction is scheduled to begin, provided that in the case of emergency construction projects, such notice shall be provided as far in advance of the start of construction as is practicable. Such notice shall include information on the district's obligations under this section to provide a safe school environment during construction projects. Such notice requirement may be met by publication in district newsletters, direct mailings, or holding a public hearing on the project to inform parents, students, school personnel and community members.

PART 13 - (e) General safety and security standards for construction projects.

PART 14 - (1) All construction materials shall be stored in a safe and secure manner.

PART 15 - (2) Fences around construction supplies or debris shall be maintained.

PART 16 - (3) Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.

PART 17 - (4) During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.

PART 18 - (5) Workers shall be required to wear photo identification badges at all times for identification and security purposes while working at occupied sites.

PART 19 - (f) Separation of construction areas from occupied spaces.

PART 20 - Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. 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.

PART 21 - (1) A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

PART 22 - (2) Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

PART 23 - (3) All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.

PART 24 - (g) Maintaining exiting and ventilation during school construction projects.

PART 25 - The following information shall be included in all plans and specifications for school building projects:

PART 26 - (1) A plan detailing how exiting required by the applicable building code will be maintained during construction. The plan shall indicate temporary construction required to isolate construction equipment, materials, people, dust, fumes, odors, and noise during the construction period. Temporary construction details shall meet code-required fire ratings for separation and corridor enclosure. At a minimum, required exits, temporary stairs, ramps, exit signs, and door hardware shall be provided at all times.

PART 27 - A plan detailing how adequate ventilation will be maintained during construction. The plan shall indicate ductwork which must be rerouted, disconnected, or capped in order to prevent contaminants from the construction area from entering the occupied areas of the building. The plan shall also indicate how required ventilation to occupied spaces affected by construction will be maintained during the project.

PART 28 - (h) Fire and hazard prevention.

PART 29 - Areas of buildings under construction that are to remain occupied shall maintain a certificate of occupancy. In addition, the following shall be strictly enforced:

PART 30 - (1) No smoking is allowed on public school property, including construction areas.

PART 31 - (2) During construction daily inspections of district occupied areas shall be conducted by school district personnel to assure that construction materials, equipment or debris not block fire exits or emergency egress windows.

PART 32 - (3) Proper operation of fire extinguishers, fire alarm, and smoke/fire detection systems shall be maintained throughout the project.

PART 33 - (i) Noise abatement during construction and maintenance activities.

PART 34 - Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken. Noise level measurements (dba) shall be taken with a type 2 sound level meter in the occupied space in a location closest to the source of the noise. Complaints regarding excessive noise shall be addressed through the health and safety committee. The district should anticipate those times when construction noise is unacceptable and incorporate “no work” periods into the bid specifications.

PART 35 - (j) Control of chemical fumes, gases, and other contaminants during construction and maintenance projects.

PART 36 - The bid specifications and construction contracts for each construction project shall indicate how and where welding, gasoline engine, roofing, paving, painting or other fumes will be exhausted. Care must be taken to assure fresh air intakes do not draw in such fumes.

PART 37 - (1) The bid specifications shall require schedules of work on construction and maintenance projects which include time for off-gassing of volatile organic compounds introduced during construction before occupancy is allowed. Specific attention is warranted for activities including glues, paint, furniture, carpeting, wall coverings, and drapery. Manufacturers shall be contacted to obtain information regarding appropriate temperatures and times needed to cure or ventilate the product during use and before safe occupancy of a space can be assured. Building materials or furnishings which off-gas chemical fumes, gases, or other contaminants shall be aired out in a well ventilated heated warehouse before it is brought to the project for installation or the manufacturer's recommended off-gassing periods must be scheduled between installation and use of the space. If the work will generate toxic gases that cannot be contained in an isolated area, the work must be done when school classes and programs are not in session. The building must be properly ventilated and the material must be given proper time to cure or off-gas before re-occupancy.

PART 38 - (2) Manufacturer's material safety data sheets (MSD) shall be maintained at the site for all products used in the project. MSDS must be provided to anyone who requests them. MSDS indicate chemicals used in the product, product toxicity, typical side effects of exposure to the product and safe procedures for use of the product.

PART 39 - (k) Asbestos abatement protocols.

PART 40 - All asbestos abatement projects shall comply with all applicable Federal and State laws including but not limited to the New York State Department of Labor industrial code rule 56 (12 NYCRR 56), and the Federal Asbestos Hazard Emergency Response Act (AHERA), 40 CFR part 763 (Code of Federal Regulations, 1998 Edition, Superintendent of Public Documents, U.S. Government Printing Office, Washington, DC 20402; 1998; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). Large and small asbestos projects as defined by 12 NYCRR 56 shall not be performed while the building is occupied. Minor asbestos projects defined by 12 NYCRR 56 as an asbestos project involving the removal, disturbance, repair, encapsulation, enclosure or handling of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material may be performed in unoccupied areas of an occupied building in accordance with the above referenced regulations.

PART 41 - (l) Lead paint.

PART 42 - Any construction or maintenance operations which will disturb lead based paint will require abatement of those areas pursuant to protocols detailed in the “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing” (June 1995; U.S. Department of Housing and Urban Development, Washington, D.C. 20410; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). All areas scheduled for construction as well as areas of flaking and peeling paint shall be tested for the presence of lead and abated or encapsulated in accordance with the above noted guidelines.

PART 43 - (m) Radon.

PART 44 - Districts shall take responsibility to be aware of the geological potential for high levels of radon and to test and mitigate as appropriate. This information is available from the New York State Department of Health Radon Measurement Database.

PART 45 - (n) Post construction inspection.

PART 46 - The school district or board of cooperative educational services shall provide the opportunity for a walk-through inspection by the health and safety committee members to confirm that the area is ready to be reopened for use.

END OF SECTION 00 90 00

SECTION 011000 – SUMMARY OF WORK – GC

PART 1 - GENERAL

1.1. PROJECT INFORMATION

A. Project: Rockland BOCES P-TECH C-TECH Building
B. Project Location: 65 Parrott Road, West Nyack NY 10994
C. Owner: Rockland BOCES
D. Architect: KSQ Design
E. Construction Manager: ACCI: Arris Contracting Company Inc.
F. The overall scope of work includes:
    1. New Rockland BOCES P-TECH C-TECH Building including all related sitework
G. Contracts:
    1. The project will be construction under a **Single prime General Construction (GC) Contract-1**. All notations and references regarding General Contractor, General Work Contractor, Mechanical Contractor, Mechanical Work Contractor, Electrical Contractor, Electrical Work Contractor, Plumbing Contractor, Plumbing Work Contractor GC, GWC, MC, MWC, PC, PWC, EC, EWC, Sitework Contractor, Kitchen Equipment Contractor, Fire Protection Contractor are synonymous with **General Construction (GC) Contract-1**. The GC will be responsible for communicating, coordinating and scheduling procurement from the district vendors and state contracts with the following:
        a. Communications *
        b. Public Address and Mass Notification Systems*
        c. Intercommunications and Program Systems*
        d. Clock Systems*
        e. Access Control*
        f. Intrusion Detection System / Lockdown*
        g. Video Surveillance*
        h. BMS (HVAC) / Controls*
        i. Owner Furnished items installed by GC*
        j. Furniture (Provided and Installed by Owners Vendor)

        *Refer to responsibility matrix provided in 01 10 00.1 Appendix A for more specific and detailed allocation of responsibilities.

1.2. DIVISION OF WORK

GC 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 All drawings and specifications sections.

1.3. GENERAL REQUIREMENTS – GC CONTRACT

A. All Contract Drawings and Specifications
B. 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 balance of specifications sections

C. Special Notes:

1. Work hours M-F 7:00AM – 4:30PM or as per the PLA Agreement. Contractor will appropriately provide labor for the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
2. GC is responsible for providing a min of (1) Full time experienced construction project manager and (1) full time senior superintendent specifically assigned to this project with a minimum of 10 years of relevant construction experience. GC to provide resume for each within 10 days of award for review by then Owner, Architect and CM.
3. GC to conduct all Subcontractor meetings and coordination meetings. GC to attend Owner, Architect & Construction Manager meetings. Construction Manager will conduct these meetings.
4. GC to provide sign in sheets daily reflecting the project site manpower county and submit to the CM.
5. Rerouting existing underground utilities (Electric, Storm, Water, Sewer & Communications) prior to commencement of footings and foundations. All existing buildings, Guard House and signage to be in use and fully operational throughout the duration of the project. Contractor to perform subsurface GPR mapping of all existing utilities prior to excavations within the work area. All utility markout is to be maintained through construction completion. See specific utility responsibility notes on drawing C201
6. The Mechanical Systems are intended to operate as standalone. The GC shall provide all parts, labor and components as required to ensure a fully operational standalone system. The Controls Contractor (by owner) shall provide any monitoring or set points of said systems as indicated by the contract documents.
7. The Building Management System (BMS) HVAC Controls will be provided by the owner under separate contract.
8. GC shall drape and enclose the addition with fire rated reinforced poly prior to the placement of concrete Slab on Grade and Slab on Decking.
9. GC will install metal studs, plywood sheathing, plastic, for weather tight and secure assembly at window and door areas, until permanent windows and doors are installed.
10. GC to protect concrete flatwork scheduled to be exposed (ground, finished or polished) until the completion of the project from any foreign materials (oils, paints, stain). Refer to specification.
11. Delivery black out times- No Contractor trucks/deliveries are allowed during school bus times as indicated by owner approx. 7:00am-8:30am or 2:00pm -3:30pm. Black out time frames apply the Campus Main Entrance Only.
12. Contractor to provide all permitting needed to allow for construction entrance (curb cut) along with traffic control for all deliveries (labor/equipment).
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, the owner will perform the work with others and deduct the cost from the contractor.

1.4. PRIME CONTRACTOR'S USE OF PREMISES

A. 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.

B. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner 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.

C. Owner's representative(s) will cover the project for the standard Monday – Friday shift. If a contractor requests additional hours to make up schedule time or weekends, he will need to reimburse Owner for additional coverage or costs (e.g. – Architect, Construction Manager, etc.) at their contractual rate.

D. 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-contractors 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.

E. After the 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.

F. 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.

G. 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 from the Owner, which may be withheld in the sole discretion of the Owner.

H. The Contractor(s) 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 building adjacent to the site of the work or the building in the event of partial occupancy.

I. 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.

J. GC Contractor is responsible for maintaining a safe jobsite. This includes actively reviewing their work areas to ensure that they are in compliance with all required OSHA 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, hard hats, proper work boots, safety harness, safety glasses, etc.

K. Smoking(any tobacco use), drinking alcoholic beverages or open fires will not be permitted on the project site.

L. Utility Outages and Shutdown:
   1. Limit the disruption of utility services to hours the building is unoccupied, weekends or holidays at no additional cost.
   2. Do not disrupt or shut down line safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days' notice to Owner and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.
   4. All costs for manning of temporary shutdowns and utility crossovers, including 24-hour fire watch if necessary, are included in the contractor's bid regardless of weekend, holiday, etc.

1.5. OCCUPANCY REQUIREMENTS

A. 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.

B. The Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner occupancy.

C. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

D. 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.

E. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions of the building.

1.6. DEFINITIONS

A. Definitions as applied to "Contractors" involved with the work of this Project:
   1. "The Contractor" or "Contractor" meaning that Respective Prime Contractor normally responsible for that work referenced.

2. “Respective Prime Contractor" meaning either the – General Contractor, Plumbing, HVAC, Electrical, Sitework, Fire Protection Contractors normally responsible for the referenced work.
3. “Trade Contractor” meaning that Respective Prime Contractor as above; and such other terms relating to Contractors to be taken in context with respect to the referenced work.
4. 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”.

B. 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.
C. The Owner will purchase certain items required for the overall operation of this facility through outside vendors.
D. The Contractor(s) will cooperate with said vendors as may be necessary to permit the work to be accomplished.
   1. The cooperation may extend to the receiving, unloading and placement of said equipment if directed by the Owner.
   2. Each Contractor is advised that the Owner may enter into separate contracts as may be in their best interest.
   3. 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.

1.7. ADDITIONAL SECURITY PROVISIONS

A. All Contractor’s employees shall use a single means of access and egress, except in the case of emergency, to be designated by the Construction Manager.
B. 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.

1.8. ASBESTOS AND LEAD PAINT AWARENESS REQUIREMENTS

A. Contractor agrees not to use or permit the use of any asbestos containing material in or on any property belonging to the Owner.
B. For purposes of this requirement, asbestos free shall mean free from all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite, both in friable and non-friable states and without regard to the purposes for which such material is used.

1.9. CONSTRUCTION TIME AND PHASING REQUIREMENTS

A. 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.
B. Time of Completion shall be as established in the Milestone Schedules (Section 011100).
C. The Contractor shall maintain fences and barricades at all times and shall repair/restore and/or pay for any temporary fence damaged by their work.
D. Maintain at all times, all exits and walkways.
E. 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.
F. Construction Phasing: The phasing and/or milestone schedule contained in Section 011100 has been established for the overall construction of the project.
G. Electrical and mechanical services to the functioning spaces shall be maintained at all times.
H. Swing-overs to new facilities shall be made so as to cause the least interruption to the facilities’ operations.
I. The Contractor shall provide and maintain all required separations between old and new construction to prevent:
    1. Unauthorized entrance to construction areas by others than Architect, Construction Manager, or Owner.
    2. Heat loss from existing building, water (rain or ground) infiltration into existing building.
J. 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.
K. Site development work shall proceed in such a manner to cause the least amount of disruption to the ongoing operations as possible.

1.10. PROOF OF ORDERS, DELIVERY DATES AND SUPPLY CHAIN TRACKING

[Coordinate with Sections 01 32 16 and 01 33 00.]

A. 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.
B. Due to potential disruption of material supply-chains, the Contractor(s) 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, etc.) The Owner will pay for these stored items delivered to the jobsite in accordance with Section 01 29 00.

C. This information shall be incorporated within the progress schedules so required as part of Section 01 32 16 and 01 33 00 and shall be monitored so as to ensure compliance with promised dates.

1.11. FIELD MEASUREMENTS

Each Respective Contractor shall take all necessary field measurements prior to fabrication, release and installation of work and shall assume complete responsibility for accuracy of same.

1.12. 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 from the Contractor and verified correct.

1.13. SCHEDULES

The milestone schedule presented in the documents is for bidding and general purposes. The GC Prime Contractor will provide an overall Project Schedule to be updated on a monthly basis.

General:

A. 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 during the progress of the work.
B. 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.
C. 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.
D. The Contractor shall work in coordination with work of other Contractors and Owner.
E. Contractor is required to comply with proper sequencing of work and provide all Contractors sufficient time to install their work (e.g. – HVAC Contractor provide preassembled roof curbs on roof in time for the GC roofing work.) 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.

1.14. ADDITIONAL REQUIREMENTS

The following are additional general and special requirements which will govern the work of the projects covered by these documents:

A. 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.
B. If the work is complete but the area has not been cleaned or debris and equipment remain, the Owner and/or Construction Manager will notify the Contractor of the deficiencies. The Contractor will have up to four hours to clean the specified area(s) to the satisfaction of the Owner and/or Construction Manager. If the Contractor fails to do so, the Owner reserves the right to prepare the area for occupancy using their own resources and deduct the associated costs from the Contract amount.
C. Contractor shall limit his operations including storage of materials and prefabrication to areas within the Contract Limit Lines.
D. 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.
E. Contractor shall obtain and pay for off-site storage as needed to maintain the Owner's use of their premises. The costs of any required storage shall not be an additional expense to the Owner.
F. 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.
G. The intention of the work is to follow a logical sequence; however, the Contractor may be required by Construction Manger 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.
H. Contractor shall submit a three-week (man-loaded 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.
I. 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 coordination drawings and actively participate in resolving discrepancies, conflicts, interferences, etc.
J. 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.
K. Each Contractor is responsible to supply and install all blocking/bracing necessary to properly secure their work. This responsibility includes coordinating the installation in concealed areas without delaying other trades.
L. Union business shall not be conducted on site. Any Union representative that visits 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 representatives 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.

M. 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 work implies acceptance of existing conditions.
N. 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.
O. 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.
P. Contractor shall coordinate with the Construction Manager for lay down areas, staging areas, and overall use of project site.
Q. No recycled import fill materials are permitted.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 011000

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RESPONSIBILITY MATRIX

01 10 00.1 Appendix - Responsibility Matrix

		All notations and references regarding General Contractor, General Work Contractor, Mechanical Contractor, Mechanical Work Contractor, Electrical Contractor, Electrical Work Contractor, Plumbing Contractor, Plumbing Work Contractor GC, GWC, MC, MWC, PC, PWC, EC, EWC, Sitework Contractor, Kitchen Equipment Contractor, Fire Protection Contractor are synonymous with **General Construction (GC) Contract-1**	**Furnished by the Owner's Vendor**	F&I by DAY AUTOMATION	Owners Vendor Name	Owners Vendor Name	Owners Vendor Name	**Installed by Owner**	**Furnished by General Work Contractor**	**Installed by General Work Contractor**	**Furnished by Mechanical Work Contractor**	**Installed by Mechanical Work Contractor**	**Furnished by Electrical Work Contractor**	**Installed by Electrical Work Contractor**	**Furnished by Plumbing Work Contractor**	**Installed by Plumbing Work Contractor**	**Furnished by Fire Protection Contractor**	**Installed by Fire Protection Contractor**	**Special Notes**
Note: For any items not specifically listed below, the Contractor responsible for the specification section shall provide the item																			
02 31 32	GEOTECHNICAL REPORT																		AS NEEDED FOR EACH TRADES WORK
02 33 13	UNDERGROUND UTILITY																		AS NEEDED FOR EACH TRADES WORK
02 41 00	DEMOLITION (CIVIL)							■	■										
03 30 00	CAST IN PLACE CONCRETE (CIVIL)							■	■										
03 30 00	CAST IN PLACE CONCRETE (STRUCTURAL)							■	■										
03 35 43	POLISHED CONCRETE FINISHING							■	■										
03 54 00	SELF-LEVELING TOPPINGS							■	■										
04 05 23	MASONRY CAVITY WALL DRAINAGE							■	■										
04 20 00	UNIT MASONRY							■	■										
04 50 00	COLD WEATHER MASONRY							■	■										
04 72 00	CAST STONE MASONRY							■	■										
05 12 00	STRUCTURAL STEEL FRAMING							■	■										
05 21 00	STEEL JOIST FRAMING							■	■										
05 31 00	STEEL DECKING							■	■										
05 40 00	COLD FORMED METAL FRAMING							■	■										
05 50 00	METAL FABRICATIONS							■	■										
05 51 00	METAL STAIRS							■	■										
05 52 13	PIPE AND TUBE RAILINGS							■	■										
05 73 00	ARCHITECTURAL METAL RAILINGS							■	■										
06 10 00	ROUGH CARPENTRY							■	■										As needed per trade
06 16 00	SHEATHING							■	■										
06 20 23	INTERIOR FINISH CARPENTRY							■	■										
06 40 23	INTERIOR ARCHITECTURAL WOODWORK							■	■										
07 13 26	SELF-ADHERING SHEET WATERPROOFING							■	■										
07 21 00	THERMAL INSULATION							■	■										
07 27 13	FIRE RESISTANT SELF-ADHERING MEMBRANE AIR & VAPOR BARRIER							■	■										
07 27 26	FIRE RESISTANT FLUID-APPLIED MEMBRANE AIR BARRIERS							■	■										
07 53 23	EPDM ROOFING							■	■										
07 62 00	SHEET METAL FLASHING AND SPECIALTIES							■	■										
07 72 00	ROOF ACCESSORIES							■	■										As needed per trade penetration
07 84 13	PENETRATION FIRESTOPPING							■	■										As needed per trade penetration
07 84 46	FIRE-RESISTIVE JOINT SYSTEMS							■	■										As needed per trade penetration

07 92 00	JOINT SEALANTS						■	■									As needed per trade penetration
07 95 00	EXPANSION CONTROL						■	■									
08 11 13	HOLLOW METAL DOORS AND FRAMES						■	■									
08 12 55	FIBERGLASS REINFORCED POLYESTER (FRP) DOORS						■	■									
08 14 16	FLUSH WOOD DOORS						■	■									
08 31 13	ACCESS DOORS AND FRAMES						■	■									
08 41 13	ALUMINUM FRAMED ENTRANCES AND STOREFRONTS						■	■									
08 44 13	GLAZED ALUMINUM CURTAIN WALL						■	■									
08 51 13	ALUMINUM WINDOWS						■	■									
08 56 67	BULLET RESISTANT TRANSACTION WINDOW						■	■									
08 71 00	DOOR HARDWARE						■	■									See Access Control 28 13 00 for further coordination
08 73 40	OVERHEAD ROLLING DOOR AND GRILLE OPERATOR						■	■									
08 80 00	GLAZING						■	■									
08 80 01	TRANSLUCENT INUSLATED GLAZING PANEL						■	■									
08 83 00	MIRRORS						■	■									
08 87 17	SAFETY AND SECURITY GLAZING FILM						■	■									
09 21 16	GYPSUM BOARD SHAFT WALL ASSEMBLIES						■	■									
09 22 16	NON-STRUCTURAL METAL FRAMING						■	■									
09 29 00	GYPSUM BOARD						■	■									
09 30 13	CERAMIC TILE						■	■									
09 50 00	ACOUSTICAL WOOD CEILING PANELS						■	■									
09 51 23	ACOUSTICAL CEILING TILE						■	■									
09 64 66	WOOD GYMNASIUM FLOORING						■	■									
09 65 13	RESILIENT BASE AND ACCESSORIES						■	■									
09 65 19	RESILIENT FLOORING						■	■									
09 67 23	RESINOUS FLOORING						■	■									
09 68 13	TILE CARPETING						■	■									
09 77 20	DECORATIVE FIBERGLASS REINFORCED WALL PANELS						■	■									
09 84 33	SOUND-ABSORBING WALL UNITS						■	■									
09 91 00	PAINTING						■	■									
10 11 00	VISUAL DISPLAY SURFACES						■	■									
10 14 00	INTERIOR SIGNAGE						■	■									
10 19 00	WALL AND DOOR PROTECTION						■	■									
10 21 00	TOILET PARTITIONS						■	■									
10 21 00	EQUIPMENT SCREENS						■	■									
10 28 00	TOILET AND BATH ACCESSORIES																
	TA-1 Toilet Paper Roll Holder	■						■									
	TA-2 Mirror						■	■									
	TA-3 Sanitary Napkin Disposal						■	■									
	TA-4 Liquid Soap Dispenser	■						■									
	TA-5 Paper Towel Dispenser and Waste Receptacle	■						■									
	TA-6 Wall Hung Toilet										■	■					
	TA-7 Wall Hung Urinal										■	■					
	TA-8 Grab Bar						■	■									
	TA-9 Shelf with Mop and Broom Holders						■	■									
	TA-10 Baby Changing Station						■	■									
	TA-11 Lav 1 Station										■	■					
	TA-12 Lav 2 Station										■	■					
	TA-13 Lav 3 Station										■	■					
	TA-14 Lav 4 Station										■	■					
	TA-15 Lockers						■	■									
	TA-16 Hand Dryer						■	■									
	TA-17 Toilet Partitions						■	■									
	TA-18 Robe Hook						■	■									
	TA-19 ADA Bench						■	■									

| | | |

23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC									■	■							
23 07 13	DUCT INSULATION									■	■							
23 07 16	HVAC EQUIPMENT INSULATION									■	■							
23 07 19	HVAC PIPING INSULATION									■	■							
23 09 00	HVAC INSTRUMENTATION AND CONTROLS									■	■							
23 09 13	ENCLOSED MOTOR CONTROLLERS									■	■							
23 09 33	VARIABLE FREQUENCY DRIVES									■	■							
23 09 93	SEQUENCE OF OPERATIONS									■	■							
23 23 00	REFRIGERANT PIPING									■	■							
23 31 13	METAL DUCTS									■	■							
23 33 00	AIR DUCT ACCESSORIES									■	■							
23 34 23	HVAC POWER VENTILATORS									■	■							
23 37 13	DIFFUSERS, REGISTERS, AND GRILLES									■	■							
23 37 16	DUCTSOX-HOOPS (HIS) SEDONA-XM NP									■	■							
23 74 13	CENTRAL STATION AIR HANDLING EQUIPMENT									■	■							
23 74 16	ROOFTOP UNITS									■	■							
23 74 23	MAKEUP AIR UNITS									■	■							
23 81 29	VARIABLE REFRIGERANCT VOLUME HVAC SYSTEM									■	■							
23 82 16	AIR COILS									■	■							
23 81 26	SPLIT-SYSTEM AIR-CONDITIONERS									■	■							
	BUILDING AUTOMATION SYSTEM - CONTROLS CONTRACTOR	■																
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL											■	■					
26 05 19	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES											■	■					
26 05 23	CONTROL-VOLTAGE ELECTRICAL POWER CABLES											■	■					
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS											■	■					
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS											■	■					
26 05 33	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS											■	■					
26 05 36	CABLE TRAYS FOR ELECTRICAL SYSTEMS											■	■					
26 05 39	UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS											■	■					
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS											■	■					
26 05 73	OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY											■	■					
26 09 23	LIGHTING CONTROL DEVICES											■	■					
26 12 00	MEDIUM-VOLTAGE DISTRIBUTION											■	■					
26 22 00	LOW-VOLTAGE TRANSFORMERS											■	■					
26 24 13	SWITCHBOARDS											■	■					
26 24 16	PANELBOARDS											■	■					
26 27 26	WIRING DEVICES											■	■					
26 28 13	FUSES											■	■					
26 28 16	ENCLOSED SWITCHES AND CIRCUIT BREAKERS											■	■					
26 29 23	VARIABLE FREQUENCY MOTOR CONTROLLERS											■	■					
26 32 13	ENGINE GENERATORS											■	■					
26 36 00	TRANSFER SWITCHES											■	■					
26 43 13	TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS											■	■					
26 51 00	INTERIOR LIGHTING											■	■					
26 56 00	EXTERIOR LIGHTING											■	■					
27 05 00	COMMON WORK RESULTS FOR COMMUNICATIONS											■	■					
27 11 00	COMMUNICATIONS EQUIPMENT ROOM FITTINGS											■	■					
27 13 00	COMMUNICATIONS BACKBONE CABLING																	
	Plywood Mounting Board (painted)											■	■					Items here may relate back to 270500/271100
	Network Cabinet (locations) (wall or floor)	■											■					Items here may relate back to 270500/271100
	Power requirements if any											■	■					Items here may relate back to 270500/271100
	Cabling and Pathways											■	■					Items here may relate back to 270500/271100
	Connecting Cords (Patch cords)	■				■												Items here may relate back to 270500/271100
	Patch Panels											■	■					Items here may relate back to 270500/271100
	Servers	■				■												Items here may relate back to 270500/271100
	End Devices and adapters											■	■					Items here may relate back to 270500/271100

		Wireless Access Points	■									■					Items here may relate back to 270500/271100
		Phone System		■													Items here may relate back to 270500/271100
		Network Switches	■									■					Items here may relate back to 270500/271100
		UPS	■														Items here may relate back to 270500/271100
		Fiber into the building from building #3 to the demarcation point									■	■					Items here may relate back to 270500/271100
		Fiber after it enters the building from demarcation point to a closet / cabinet									■	■					Items here may relate back to 270500/271100
		Fiber between closets									■	■					Items here may relate back to 270500/271100
27 15 00	COMMUNICATIONS HORIZONTAL CABLING																
27 51 16	PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS																
		Plywood Mounting Board (painted)									■	■					
		Cabinet (location) (wall or floor)									■	■					
		Power / Data requirements if any									■	■					
		Devices / Equipment	■									■					
		Cabling and Pathways									■	■					
		Programming / Training									■	■					
		UPS NONE REQUIRED									■	■					
27 51 23	INTERCOMMUNICATIONS AND PROGRAM SYSTEMS																
		Plywood Mounting Board (painted)									■	■					
		Cabinet (location) (wall or floor)									■	■					
		Power / Data requirements if any									■	■					
		Devices / Equipment	■									■					
		Cabling and Pathways									■	■					
		Programming / Training									■	■					
		UPS NONE REQUIRED									■	■					
27 53 13	CLOCK SYSTEMS																
		Plywood Mounting Board (painted)									■	■					
		Cabinet (location) (wall or floor)									■	■					
		Power / Data requirements if any									■	■					
		Devices / Equipment	■									■					
		Cabling and Pathways									■	■					
		Programming / Training									■	■					
		UPS NONE REQUIRED									■	■					
28 05 00	COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY										■	■					
28 05 13	CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY										■	■					
28 13 00	ACCESS CONTROL																
		Plywood Mounting Board (painted)									■	■					
		Cabinet (location) (wall or floor)		■													
		Power / Data requirements if any									■	■					
		Head End Equipment (panels, modules)		■													
		Devices (card readers, request to exit sensors, door contacts)		■													
		Wireless locks (Allegion AD400 model)		■													
		Wired Electronic Door Hardware									■	■					Power for these locations by EC
		Connections to Access Control System		■													
		Mounting and Specific Wiring for AC systems		■													
		Cabling and Pathways									■	■					
		Programming / Training		■													
		UPS NONE REQUIRED															
28 16 00	INTRUSION DETECTION																
		Plywood Mounting Board (painted)									■	■					
		Cabinet (location) (wall or floor)		■													
		Power / Data requirements if any									■	■					
		Head End Equipment		■													
		Devices		■													
		Cabling and Pathways									■	■					
		Programming / Training		■													
		UPS NONE REQUIRED															

| | | |

SECTION 011100 – MILESTONE SCHEDULE

PART 1 - GENERAL

1.1. MILESTONE

The following milestone schedule serves as basis for bidding. A Final Construction Schedule will be developed by the General Contractor within 15 days of Letter of Intent to Award the Contracts. Contractor will coordinate activities, forward submittals, deliver materials and provide the necessary workforce to meet the milestones listed below.

1.2. MILESTONE SCHEDULE

Rockland BOCES P-TECH C-TECH Building	Start	Finish
• Mobilization, Staging & Protections (see plan included in 015000)	09/29/25	10/03/25
• Utility Relocations, Sitework, Footings, Foundations and Backfill	---	03/06/26
• Structural Steel, Load Bearing Masonry, Decking and Roofing to make Watertight. (Drape building with reinforced poly)	---	05/29/26
• Building Shell Completion with Final Masonry, Windows, Entrances & Doors.		09/28/26
• Temporary Heat	10/16/26	03/4/27
• Kitchen Equipment Installation	12/8/26	01/18/27
• Substantial Completion	---	03/5/27
• All Remaining work to allow for Occupancy by the Owner	---	04/2/27
CLOSEOUT		
• Contractor Closeout (review specifications) 30 days past substantial completion	---	04/05/27

1. 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 execute 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 Manager, 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 Owner consultant's contractual rate.

2. Due to space limitations at the jobsite, Contractor is specifically notified that jobsite material lay-down areas will need to be relocated as necessary. All contractors are required to comply with Construction Managers direction and sequencing.
3. Any additional costs incurred by the owner's representatives, including the Construction Manager, Architect, Owner's staff, Owner's consultants and any related costs, due to schedule overruns beyond the milestone dates, if determined to be the contractor's responsibility, will result in a deduct change order at the contractual rate established by the Owner or their representatives.
4. 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.
5. Contractor is advised that "Time is of the essence" as per the General Conditions of the contract 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 General Conditions.
6. Contractor is specifically notified that they must properly staff the project with a competent field superintendent and a sufficient supply of workers to maintain progress and flow of the work as required by the schedule, and to coordinate/install in a timely manner to facilitate the work of other trades.
7. Contractor is hereby informed that construction will proceed in phases, requiring temporary disconnection, reconnection, and maintenance of utilities and services as needed. It is imperative to ensure uninterrupted use of essential services (such as mechanical, electrical, fire alarm, and public address systems) to all occupied areas throughout the project

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011100

SECTION 01 2100 – 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.
   1. 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:
   1. Contingency allowances.

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Modification Procedures" specifies procedures for submitting and handling Change Orders.
   2. Division 1 Section "Quality Control Services" specifies procedures governing the use of allowances for inspection and testing.

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 Change Orders that indicate amounts to be charged to the allowance.

B. The Contractor's supervision, 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 amounts remaining in the contingency allowance 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.
   1. 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.

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

1. Allowance #00, General Allowance: **CONTRACT 1** shall include a contingency allowance totaling **$350,000,** for use according to the Owner's instructions.

2. Allowance #02, Trench Rock Removal: **CONTRACT 1** shall include a contingency allowance of **50CY** for use according to the Owner's instructions.

3. Allowance #01, Replacement of Unsuitable Soils: **CONTRACT 1** shall include a contingency allowance of **200CY** for use according to the Owner's instructions.

END OF SECTION 01 2001

SECTION 01 22 00 - UNIT PRICES

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 administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 01 45 00 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for supervision, delivery, installation, material handling, bonds, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

1. Notify Construction Manager, Architect and Owner, as far in advance as possible, of the recording of measurements so that they may be observe existing conditions, work being performed and measurements being made.
2. Allow for and afford Construction Manager amble time, space and equipment to observe measurements and to verify measurements and elevations
3. Field Notes of all measurements for payment purpose delivered to the Construction Manager daily.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

1.5 Measurement Requirements

A. All required measurements shall be made by the contractor with the Architect and Construction Manager

B. Any measurements not witnessed by Architect and Construction Manager and which cannot be verified or substantiated will not be made.

C. Coordinate measurements monthly, for the preparation of periodic pay estimates.

D. Where payments will be made for removing rock and existing materials, notify Architect so that he may witness the measurements
   1. All materials removed without conforming to the above procedures, which Engineer cannot verify or substantiate, will not be paid for.
   2. Maintain complete, neat, clean, and legible field notes for all measured items.
   3. Notes shall contain spaces for Contractor's and Architect's signatures plus additional space for comments.
   4. An original and a carbon copy shall be made for all noted and one copy shall be turned over to Construction Manager daily.
   5. The Construction manager signature shall not be constituted as an acceptance of the work, or the measurement made, but shall mean that he was present when the measurements were made.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

General Contractor – GC-01

A. Unit Price GC #1: Construction Debris Removal
   1. Description: All labor and material to haul and dispose of any identified construction debris off site to be used as an add or deduct to base bid quantities. NOTE: Construction Debris is not anticipated.
   2. Unit of Measurement: Per Cubic Yard (CY) of construction debris.

B. Unit Price GC #2: Trench Rock Removal
   1. Description: All labor and material to excavate, haul and dispose of any identified trench rock off site to be used as an add or deduct to base bid quantities. NOTE: Test Pits do no indicate the presence of rock.
   2. Unit of Measurement: Per Cubic Yard (CY) of trench rock.

C. Unit Price GC #3: Unsuitable Soil Removal
   1. Description: All labor and material to excavate, haul and dispose of any identified unsuitable soil off site to be used as an add or deduct to base bid quantities. NOTE: Unsuitable Soil is not anticipated.
   2. Unit of Measurement: Per Cubic Yard (CY) of unsuitable soil.

END OF SECTION 01 22 00

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SECTION 01 23 00 - ALTERNATES

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 administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the dame conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **ALTERNATE #1 – – MOBILE WORKSTATIONS IN KITCHEN #1 (ADD):** Contractor shall provide mobile counters with upgraded finishes for kitchen #1 only as called for in specification section 11 40 00, Item A16.

B. **ALTERNATE #2 – Canopy (ADD):-** Metal Canopy extending from new building to Building #3, anchored with Metal columns and concrete footings. Down Lighting at underside of Canopy metal roof. Canopy Approx. Length – 145 FT. Approx. Width – 8FT. Refer to Architectural, Structural and Electrical Drawings and specification 10 53 00.

C. **ALTERNATE #3 – 2nd Floor Roof Garden Concrete Pavers (ADD):** Roof Garden area with Approx. 2,002 SF of large format stone pavers on pedestals, at top of EPDM roofing. See Sheet A-131 & A-314 for details. Refer to Architectural Drawings.

D. **ALTERNATE #4 – Bullet Resistant Storefront (ADD):** Material and Installation to provide bullet resistant storefront system in lieu of non-resistant storefront for exterior storefront types A, B, G and F. See Architectural drawings and specification 13 47 17.

E. **ALTERNATE #5 -Site Trees (DEDUCT):** Material and Installation of the 10 proposed trees as shown on Civil Drawings C-101.

END OF SECTION 01 23 00

SECTION 01 2500 - SUBSTITUTION 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 handling requests for substitutions made after award of the Contract.
   1. Single Prime Contracts: Provisions of this Section apply to the construction activities of Site Work Contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
   1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
   2. Revisions to the Contract Documents requested by the Owner or Architect.
   3. Specified options of products and construction methods included in the Contract Documents.
   4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 15 days after commencement of the Work. Requests received more than 15 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
   2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
   3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
      a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.

b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
d. Samples, where applicable or requested.
e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
f. Cost information, including a proposal of the net change, if any in the Contract Sum.
g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
   a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.
3. The request is timely, fully documented, and properly submitted.
4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.

9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
11. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 2500

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SECTION 012600 – CONTRACT MODIFCATION

PART 1 – PROCEDURES - 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 reviewed Drawings and Specifications. The Architect will Use AIA Document G709 for Change Order Proposal Requests.
   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 5 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 with copy to the Construction Manager.
   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 if purchases to be made. Furnish survey data to substantiate quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts. Include labor rate breakdown sheets for each trade.
   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. Include detailed substantiation 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.

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 all costs for Supervision, bonds & insurances, for these allowances shall be included in the values of the general requirements of the 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. No Change Order or Allowance requisitions can be made or listed on the requisition, unless the formal Change Order or Allowance Disbursement paperwork has been fully executed by Contractor, Construction Manager, 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 letter. (Bond amount based on total adjusted contract value)

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

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.)

	*	% per hour	$ per hour	REGULAR BASE RATE	PREMIUM TIME BASE RATE
A. WAGE RATE PER HOUR					
BENEFITS (* Identifies benefits paid directly to the Employee.)					
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

END OF SECTION 012600

SECTION 01 29 00 – PAYMENT 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 (SOV) 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 SED 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, renovations and sitework with subtotals for each.
    b. Breakdown will be separated by school (and SED number) each with it's own stand-alone front-end sections as outlined in item 4 below. Each will have their own subtotal, so that the owner can easily see the value to date with needing to add columns.
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 amount higher than industry standard of 2.0% of contract sum). Only OCP insurance allowed for insurance line item. All other insurance costs must be distributed by contractor evenly throughout the various sections.
    b. Supervision – include a minimum of 1% of contract sum.
    c. Project Administration – include a minimum of 1% 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 2.5% of contract sum
    f. Closeout: separate lines for demobilization, Operation & maintenance manuals, closeout paperwork, demonstration & training (total for closeout minimum 2% percent of contract value)
    g. Continuous Clean-up and Final Clean-up values each at minimum of 2% of contract sum.
    h. General Contractor to add line item for Broom sweep/damp mopping at minimum of .5% of contract sum.
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. Allowances to be listed at the end of the Schedule of Values.
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 of Values Updating: Update and resubmit the Schedule of Values with the next Applications for Payment when Approved Change Orders or Executed Construction Change Directives and Approved Allowance Disbursements.

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:
    1. Submit the initial Payment Application to the Construction Manager and the Architect by the twenty fifth of the month for that month. The Construction Manager and the Architect will provide final comments within three business days of receipt on the twenty fifth of the month. If submitted later than the twenty fifth of the month, review times may be as long as five days from receipt.
    2. All required documents, including the final version of the Application for Payment, based on the comments provided by the Construction Manager and the Architect, must be received by the Construction Manager no later than the first business day of the month following the twenty fifth due date. This will allow for final review by the Construction Manager for accuracy and completeness of submitted documents. If comments are provided to the contractor, the contractor must submit a new complete package including all required corrections/updates.
    3. All final, complete, Payment Applications will be transmitted to the Owner on the 5th day of the month. Payment will be per the terms of the General Conditions of the Contract for Construction.

4. If a complete package is not submitted to the Construction Manager by the fifth of the month, they will be paid as per the terms of the Standard Form of Agreement Between Owner and Contractor.

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 and per NYSED project number indicated on drawings and specifications, which will detail that portion of the contract which is attributable to the specific building and NYSED project number indicated on drawings and specifications.

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. (No Change Order or Allowance requisitions can be made or listed on the requisition, unless the formal Change Order or Allowance Disbursement paperwork has been fully executed by Contractor, Construction Manager, Architect, and Owner).
   3. Provide digital copies of payrolls which are signed and notarized (Blue Ink) 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 1 signed and notarized digital copy (blue ink signature) of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours. The digital copy shall be complete, and attached as a single file 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. Certificates of insurance and insurance policies.
    10. Performance and payment bonds.
    11. Data needed to acquire the Owner's insurance.
    12. 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. Transmittal of required Project construction records to the Owner.
4. Removal of temporary facilities and services.
5. Removal of surplus materials, rubbish, and similar elements.

PART 2 – PRODUCTS (Not Applicable)

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 01 29 00

Section 013100 - PROJECT MANAGEMENT AND COORDINATION

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 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: 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 “Material and Equipment” for coordinating general installation.
  4. Division 1 Section “Execution and Closeout Requirements” for coordinating contract closeout.

1.3. 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, sufficiently ahead of the work progressing.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining specials procedures required for coordination. Include such items as require 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.

1.4. 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 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 15 days)
  5. A coordination meeting with all Contractors and subcontractors to review completed coordination drawings will be held within 60 days of Contract award.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
  1. 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.
  2. 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 Document. 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. CAD Files do not

necessarily represent the latest Contract Documents, existing conditions and as-builts conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.

b. 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.

c. Receiver shall not be 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.

d. Receiver shall understand that even through 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 file or media.

3. 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 charge rate to cover the architect's cost for producing.

4. 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.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1. 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.

3.2. 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.

B. RFI'S shall originate with Contractor. RFI's submitted by entities other than Contractor will be returned with no response.

1. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

C. 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 the 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.

D. 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 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 submittal.
    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 Contractors 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.

E. 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 the designated time listed to correct the

deficiency and upon completion must respond back in the internet web-based service. 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. Contractors will not be allowed to work Weekends or after hours unless the DOL has been properly notified.

END OF SECTION 013100

SECTION 013119 – 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 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: Construction Manager 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 markups.
      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 discussion 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 36 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 contractor's 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 013119

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SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contractor shall develop a full schedule, in sufficient detail and clarity of form and technique so that the contractor can plan and control 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 15 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.
   2. Interim schedule updates are to be provided monthly

B. Two (2) Week look ahead schedules included manpower allocation are due each Friday. Schedules are to be in alignment with task id’s from project schedule

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 month 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 32 33 - PHOTOGRAPHIC DOCUMENTATION

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 administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
    a. Name of Contractor.
    b. Date photograph was taken.
    c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    d. Unique sequential identifier keyed to accompanying key plan.

1.3 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.

C. Preconstruction Photographs: Before commencement of excavation take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and Construction Manager.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Architect and Construction Manager-Directed Construction Photographs: From time to time, Architect and Construction Manager will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment.
2. Vantage Points: Following suggestions by Architect and Construction Manager and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:

    a. Commencement of the Work, through completion of subgrade construction.
    b. Above-grade structural framing.
    c. Exterior building enclosure.
    d. Interior Work, through date of Substantial Completion.

G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect and Construction Manager will inform photographer of desired vantage points.

1. Do not include date stamp.

END OF SECTION 01 32 33

SECTION 01 3300 - ELECTRONIC SUBMITTAL PROCEDURES

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

B. Related Sections:

1. Division 01 Section “Payment Procedures” for submitting Applications for Payment and the schedule of values.

2. Division 01 Section “Construction Progress Schedule” for submitting schedules and reports, including Contractor’s construction schedule.

3. Division 01 Section “Execution and Closeout Requirements” for submitting operation and maintenance manuals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer’s responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer’s responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action, informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Engineer's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.

1. Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

    a. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

    b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD Version 2010.

    c. Contractor shall execute a data licensing agreement that will be supplied by Engineer.

    d. The following plot files will by furnished for each appropriate discipline:

        1) Floor plans.
        2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow 15 days for review of each submittal. Submittal will be returned to Engineer before being returned to Contractor.

D. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., BR-061000.01 or MH-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., BR-061000.01.A or MH-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.

4. Include the following information on an inserted cover sheet:

    a. Project name.
    b. Date.

c. Name and address of Engineer.
d. Name of Contractor.
e. Name of firm or entity that prepared submittal.
f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Related physical samples submitted directly.
m. Other necessary identification.

5. Include the following information as keywords in the electronic file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

E. Options: Identify options requiring selection by the Engineer.

F. Deviations: Identify deviations from the Contract Documents on submittals.

G. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Contracting Officer will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Indication of full or partial submittal.
j. Drawing number and detail references, as appropriate.
k. Transmittal number, numbered consecutively.
l. Submittal and transmittal distribution record.
m. Remarks.
n. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
—. Note date and content of previous submittal.
—. Note date and content of revision in label or title block and clearly indicate extent of revision.
—. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals that are marked with approval notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files only.

    a. Engineer, through Contracting Officer, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

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

    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

4. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based upon Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1067 mm).

3. Submit Shop Drawings in the following format:

a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

b. Samples not incorporated into the Work, or otherwise designated as Government's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer, through Contracting Officer, will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Engineer will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents.

2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.

4. Location within room or space.

5. Submit product schedule in the following format:

a. PDF electronic file.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Submit subcontract list in the following format:
    a. PDF electronic file.

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

—. Name of evaluation organization.
—. Date of evaluation.
—. Time period when report is in effect.
—. Product and manufacturers' names.
—. Description of product.
—. Test procedures and results.
—. Limitations of use.

S. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

T. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. NO EXCEPTIONS TAKEN: Where the submittal is marked "NO EXCEPTIONS TAKEN," the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.

2. MAKE CORRECTIONS NOTED (do not resubmit): Where the submittal is marked "MAKE CORRECTIONS NOTED" the work covered by the submittal may proceed provided it complies both with Engineer's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.

3. RREVISE AND RESUBMIT (see notes): Where the submittal is marked "REVISE AND RESUBMIT" do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise and prepare a new submittal according to Engineer's notations and corrections.

4. REJECTED: Where the submittal is marked "REJECTED", do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.

5. Submit Specified Item: Where the submittal is marked "Submit Specified Item", do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.

C. Informational Submittals: Engineer will review each submittal and will not return it or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

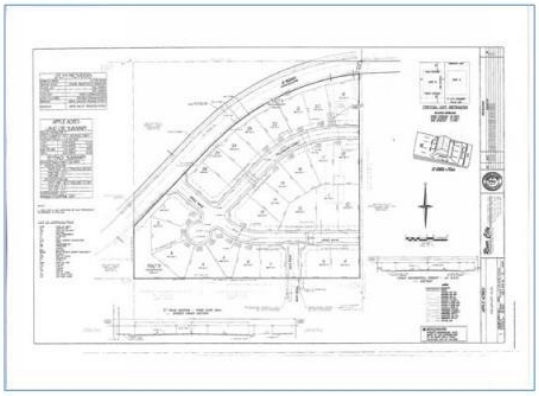
Document Orientation Guide

Correct Orientation:


GENERAL PROJECT REPORT
July 19, 2011

Swan Meadows Simple Subdivision
Grand Junction, Colorado

PREPARED BY:
Kim Kerk
Blue Star Industries
2380 G ROAD, GRAND JUNCTION, CO 81505
(970) 255-8033 ext. 130 cell (970) 640-4913



Incorrect Orientation:





END OF SECTION 00 13 00

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No: _____

SUBMITTAL COVERSHEET
Rockland BOCES P-TECH C-TEC Building

Architect:
KSQ Design
286 Madison Avenue, 22nd Floor
New York, NY 10017

Owner:
Rockland BOCES
65 Parrott Rd
West Nyack, NY 10994

Contractor: _____ **Contract:** _____

Address: _____ **Telephone:** _____

_____ **Fax:** _____

School Name: _____

Type of Submittal: **Re-submittal: [ ] No [ ] Yes**

[ ] Shop Drawings **[ ]** Product Data **[ ]** Schedule **[ ]** Sample **[ ]** _____
[ ] Test Report **[ ]** Certificate **[ ]** Color Sample **[ ]** Warranty **[ ]** _____

Submittal Description:

Product Name: _____

Manufacturer: _____

Subcontractor/ Supplier: _____

References:

Spec. Section No.: _____ **Drawing No(s):** _____

Paragraph: _____ **Rm. or Detail No(s):** _____

Architect's Review Stamp	Contractor Review Statement: These documents have been checked for accuracy and coordinated with job conditions and Contract requirements by this office and have been found to comply with the provisions of the Contract Documents. Name: Date: Company Name: **Remarks:**

_____

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SECTION 01 4200 – REFERENCES STANDARDS AND DEFINITIONS

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 DEFINITIONS

A. General: Basic contract definitions are included in the Conditions of the Contract.

B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.

D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project Site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced," when used with the term "installer," means having a minimum of 5 previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of authorities having jurisdiction.

2. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized exp

erts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on CSI's 33-Division format and MasterFormat's numbering system.

B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Streamlined Language: The Specifications generally use the imperative mood and streamlined language. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

a. The words "shall be" are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer to the Architect bef

ore proceeding for a decision on requirements that are different but apparently equal, and where it is uncertain which requirement is the most stringent.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum acceptable. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research Co.'s "Encyclopedia of Associations," available in most libraries.

F. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in the Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association 900 19th St., NW, Suite 300 Washington, DC 20006	(202) 862-5104
AABC	Associated Air Balance Council 1518 K St., NW Washington, DC 20005	(202) 737-0202
AAMA	American Architectural Manufacturers Assoc. 1540 E. Dundee Road, Suite 310 Palatine, IL 60067	(708) 202-1350
AAN	American Association of Nurserymen 1250 Eye St., NW, Suite 500 Washington, DC 20005	(202) 789-2900
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., Suite 24 Washington, DC 20001	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 Research Triangle Park, NC 27709-2215	(919) 549-8141

ABMA	American Bearing Manufacturers Assoc. 1101 Connecticut Ave., NW, Suite 700 Washington, DC 20036	(202) 429-5155
ACI	American Concrete Institute P.O. Box 19150 Detroit, MI 48219	(313) 532-2600
ACIL	American Council of Independent Laboratories 1629 K St., NW Washington, DC 20006	(202) 887-5872
ACPA	American Concrete Pipe Assoc. 8300 Boone Blvd., Suite 400 Vienna, VA 22182	(703) 821-1990
ADC	Air Diffusion Council One Illinois Center, Suite 200 111 East Wacker Dr. Chicago, IL 60601-4298	(312) 616-0800
AFBMA	Anti-Friction Bearing Manufacturers Assoc. (Now ABMA)	
AFPA	American Forest and Paper Assoc. (American Wood Council of the) 2nd Floor, 1250 Connecticut Ave., NW Washington, DC 20036	(202) 463-2455
AGA	American Gas Assoc. 1515 Wilson Blvd. Arlington, VA 22209	(703) 841-8400
AHA	American Hardboard Assoc. 1210 W. Northwest Highway Palatine, IL 60067	(708) 934-8800
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Dr., Suite 1500 Chicago, IL 60606	(312) 984-5800
AI	Asphalt Institute Research Park Dr. P.O. Box 14052 Lexington, KY 40512-4052	(606) 288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006	(202) 626-7300
AIA	American Insurance Assoc. 1130 Connecticut Ave., NW, Suite 1000 Washington, DC 20036	(202) 828-7100

AIHA	American Industrial Hygiene Assoc. 2700 Prosperit Ave., Suite 250 Fairfax, VA 22031	(703) 849-8888
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001	(312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., NW Washington, DC 20036-4700	(202) 452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Parkway, #140 Englewood, CO 80112	(303) 792-9559
ALI	Associated Laboratories, Inc. c/o HOH Chemicals 500 S. Vermont St. Palatine, IL 60067	(708) 358-7400
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875	(301) 972-1700
AMCA	Air Movement and Control Assoc. 30 W. University Dr. Arlington Heights, IL 60004-1893	(708) 394-0150
ANSI	American National Standards Institute 11 West 42nd St., 13th Floor New York, NY 10036	(212) 642-4900
AOAC	AOAC International 2200 Wilson Blvd., Suite 400 Arlington, VA 22201-3301	(703) 522-3032
AOSA	Association of Official Seed Analysts California State Seed Laboratory 1220 N St. Sacramento, CA 95814	(916) 445-4521
APA	American Plywood Assoc. P.O. Box 11700 Tacoma, WA 98411	(206) 565-6600
API	American Petroleum Institute 1220 L St., NW Washington, DC 20005	(202) 682-8000
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203	(703) 524-8800

ARMA	Asphalt Roofing Manufacturers Assoc. 6000 Executive Dr., Suite 201 Rockville, MD 20852-3803	(301) 231-9050
ASA	Acoustical Society of America 500 Sunnyside Blvd. Woodbury, NY 11797	(516) 576-2360
ASC	Adhesive and Sealant Council 1627 K St., NW, Suite 1000 Washington, DC 20006-1707	(202) 452-1500
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329	(404) 636-8400
ASME	American Society of Mechanical Engineers 345 East 47th St. New York, NY 10017	(212) 705-7722
ASPA	American Sod Producers Assoc. 1855-A Hicks Rd. Rolling Meadows, IL 60008	(708) 705-9898
ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Blvd., Suite 210 Westlake, CA 91362	(805) 495-7120
ASSE	American Society of Sanitary Engineering P.O. Box 40362 Bay Village, OH 44140	(216) 835-3040
ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103-1187	(215) 299-5400
ATIS	Alliance for Telecommunications Industry Solutions 1200 G St., NW, Suite 500 Washington, DC 20005	(202) 628-6380
AWCMA	American Window Covering Manufacturers Assoc. (Now WCMA)	
AWI	Architectural Woodwork Institute P.O. Box 1550 13924 Braddock Rd., No. 100 Centerville, VA 22020	(703) 222-1100
AWPA	American Wood Preservers' Assoc. P.O. Box 286 Woodstock, MD 21163-0286	(410) 465-3169
AWPB	American Wood Preservers' Bureau (This organization is now defunct.)	

AWS	American Welding Society 550 LeJeune Rd., NW Miami, FL 33126	(305) 443-9353
AWWA	American Water Works Assoc. 6666 W. Quincy Ave. Denver, CO 80235	(303) 794-7711
BANC	Brick Association of North Carolina P.O. Box 13290 Greensboro, NC 27415-3290	(910) 273-5566
BHMA	Builders' Hardware Manufacturers Assoc. 355 Lexington Ave., 17th Floor New York, NY 10017	(212) 661-4261
BIA	Brick Institute of America 11490 Commerce Park Dr. Reston, VA 22091	(703) 620-0010
BIFMA	The Business and Institutional Furniture Manufacturer's Association 2680 Horizon Dr., SE, Suite A1 Grand Rapids, MI 49546-7500	(616) 285-3963
CAGI	Compressed Air and Gas Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
CAUS	Color Association of the United States 409 W. 44th St. New York, NY 10036	(212) 582-6884
CBHF	State of California, Dept. of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation 3485 Orange Grove Ave. North Highland, CA 95660-5595	(800) 952-5210
CBM	Certified Ballast Manufacturers Assoc. 1422 Euclid Ave., Suite 402 Cleveland, OH 44115-2851	(216) 241-0711
CCC	Carpet Cushion Council P.O. Box 546 Riverside, CT 06878	(203) 637-1312
CDA	Copper Development Association Inc. 260 Madison Ave., 16th Floor New York, NY 10016	(212) 251-7200
CFFA	Chemical Fabrics & Film Association, Inc. c/o Thomas Associates, Inc. 1300 Sumner Ave.	

	Cleveland, OH 44115-2851	(216) 241-7333
CGA	Compressed Gas Assoc. 1725 Jefferson Davis Highway, Suite 1004 Arlington, VA 22202-4100	(703) 412-0900
CISCA	Ceiling and Interior Systems Construction Assoc. 579 W. North Ave., Suite 301 Elmhurst, IL 60126	(708) 833-1919
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Rd., Suite 419 Chattanooga, TN 37421	(615) 892-0137
CRI	Carpet and Rug Institute P.O. Box 2048 Dalton, GA 30722	(706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173	(708) 517-1200
CTI	Ceramic Tile Institute of America 12061 West Jefferson Blvd. Culver City, CA 90230	(310) 574-7800
DHI	Door and Hardware Institute 14170 Newbrook Dr. Chantilly, VA 22021-2223	(703) 222-2010
DIPRA	Ductile Iron Pipe Research Assoc. 245 Riverchase Parkway East, Suite O Birmingham, AL 35244	(205) 988-9870
DLPA	Decorative Laminate Products Assoc. 13924 Braddock Rd. Centreville, VA 22020	(800) 684-3572
ECSA	Exchange Carriers Standards Assoc. (Now ATIS)	
EIA	Electronic Industries Assoc. 2001 Pennsylvania Ave., NW Washington, DC 20006-1813	(202) 457-4900
EIMA	EIFS Industry Manufacturers Assoc. 2759 State Road 580, Suite 112 Clearwater, FL 34621	(813) 726-6477
EJMA	Expansion Joint Manufacturers Assoc. 25 N. Broadway Tarrytown, NY 10591	(914) 332-0040
ETL	ETL Testing Laboratories, Inc. P.O. Box 2040 3933 Route 11, Industrial Park	

	Cortland, NY 13045	(607) 753-6711
FCI	Fluid Controls Institute P.O. Box 9036 Morristown, NJ 07960	(201) 829-0990
FCIB	Floor Covering Installation Board 310 Holiday Ave. Dalton, GA 30720	(706) 226-5488
FGMA	Flat Glass Marketing Assoc. White Lakes Professional Bldg. 3310 S.W. Harrison St. Topeka, KS 66611-2279	(913) 266-7013
FM	Factory Mutual Systems 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, MA 02062	(617) 762-4300
FTI	Facing Tile Institute P.O. Box 8880 Canton, OH 44711	(216) 488-1211
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002	(202) 289-5440
HEI	Heat Exchange Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
HI	Hydronics Institute P.O. Box 218 35 Russo Place Berkeley Heights, NJ 07922	(908) 464-8200
HI	Hydraulic Institute 9 Sylvan Way Parsippany, NJ 07054-3802	(201) 267-9700
HMA	Hardwood Manufacturers Assoc. 400 Penn Center Blvd. Pittsburgh, PA 15235	(412) 829-0770
HPVA	Hardwood Plywood and Veneer Assoc. 1825 Michael Farraday Dr. P.O. Box 2789 Reston, VA 22090	(703) 435-2900
IBD	Institute of Business Designers 341 Merchandise Mart Chicago, IL 60654	(312) 467-1950

ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 440 South Yarmouth, MA 02664	(508) 394-4424
IEC	International Electrotechnical Commission (Available from ANSI) 1430 Broadway New York, NY 10018	(212) 354-3300
IEEE	Institute of Electrical and Electronic Engineers 345 E. 47th St. New York, NY 10017	(212) 705-7900
IESNA	Illuminating Engineering Society of North America 345 E. 47th St. New York, NY 10017	(212) 705-7913
IGCC	Insulating Glass Certification Council c/o ETL Testing Laboratories, Inc. P.O. Box 2040 Route 11, Industrial Park Cortland, NY 13045	(607) 753-6711
ILI	Indiana Limestone Institute of America Stone City Bank Building, Suite 400 Bedford, IN 47421	(812) 275-4426
IMSA	International Municipal Signal Assoc. 165 E. Union St. Newark, NY 14513	(315) 331-2182
IRI	Industrial Risk Insurers P.O. Box 5010 85 Woodland St. Hartford, CT 06102-5010	(203) 520-7300
ISA	Instrument Society of America P.O. Box 12277 67 Alexander Dr. Research Triangle Park, NC 27709	(919) 549-8411
KCMA	Kitchen Cabinet Manufacturers Assoc. 1899 Preston White Dr. Reston, VA 22091-4326	(703) 264-1690
LIA	Lead Industries Association, Inc. 295 Madison Ave. New York, NY 10017	(212) 578-4750
LPI	Lightning Protection Institute 3365 N. Arlington Heights Rd., Suite J Arlington Heights, IL 60004	(800) 488-6864
MBMA	Metal Building Manufacturer's Assoc.	

	c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
MCAA	Mechanical Contractors Association of America 1385 Piccard Dr. Rockville, MD 20850-4329	(301) 869-5800
MFMA	Maple Flooring Manufacturers Assoc. 60 Revere Dr., Suite 500 Northbrook, IL 60062	(708) 480-9138
MIA	Marble Institute of America 33505 State St. Farmington, MI 48335	(810) 476-5558
ML/SFA	Metal Lath/Steel Framing Assoc. (A Division of the National Association of Architectural Metal Manufacturers) 600 S. Federal St., Suite 400 Chicago, IL 60605	(312) 922-6222
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180	(703) 281-6613
NAA	National Arborist Assoc. The Meeting Place Mall Route 101, P.O. Box 1094 Amherst, NH 03031-1094	(603) 673-3311
NAAMM	National Association of Architectural Metal Manufacturers 600 S. Federal St., Suite 400 Chicago, IL 60605	(312) 922-6222
NAIMA	North American Insulation Manufacturers Assoc. 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314	(703) 684-0084
NAPA	National Asphalt Pavement Assoc. NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4413	(301) 731-4748
NAPF	National Association of Plastic Fabricators (Now DLPA)	
NBGQA	National Building Granite Quarries Assoc. P.O. Box 482 Barre, VT 05641	(802) 476-3115

NBHA	National Builders Hardware Assoc. (Now DHI)	
NCMA	National Concrete Masonry Assoc. 2302 Horse Pen Rd. Herndon, VA 22071-3406	(703) 713-1900
NCPI	National Clay Pipe Institute P.O. Box 759 253-80 Center St. Lake Geneva, WI 53147	(414) 248-9094
NCRPM	National Council on Radiation Protection and Measurements 7910 Woodmont Ave., Suite 800 Bethesda, MD 20814	(301) 657-2652
NCSPA	National Corrugated Steel Pipe Association 1255 23rd St., NW, Suite 850 Washington, DC 20037	(202) 452-1700
NEC	National Electrical Code (from NFPA)	
NECA	National Electrical Contractors Assoc. 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814	(301) 657-3110
NEII	National Elevator Industry, Inc. 185 Bridge Plaza, North Fort Lee, NJ 07024	(201) 944-3211
NEMA	National Electrical Manufacturers Assoc. 2101 L St., NW, Suite 300 Washington, DC 20037	(202) 457-8400
NETA	International Electrical Testing Assoc. P.O. Box 687 Morrison, CO 80465	(303) 697-8441
NFPA	National Fire Protection Assoc. One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101	(617) 770-3000 (800) 344-3555
NFPA	National Forest Products Assoc. (Now AFPA)	
NHLA	National Hardwood Lumber Assoc. P.O. Box 34518 Memphis, TN 38184-0518	(901) 377-1818
NKCA	National Kitchen Cabinet Assoc. (Now KCMA)	
NLGA	National Lumber Grades Authority	

	4400 Dominion St., Suite 103 Burnaby, BC V5G 4G3	(604) 451-7323
NOFMA	National Oak Flooring Manufacturers Assoc. P.O. Box 3009 Memphis, TN 38173-0009	(901) 526-5016
NPA	National Particleboard Assoc. 18928 Premiere Ct. Gaithersburg, MD 20879	(301) 670-0604
NPCA	National Paint and Coatings Assoc. 1500 Rhode Island Ave., NW Washington, DC 20005	(202) 462-6272
NRCA	National Roofing Contractors Assoc. 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607	(708) 299-9070
NSF	National Sanitation Foundation 3475 Plymouth Rd. P.O. Box 130140 Ann Arbor, MI 48113-0140	(313) 769-8010
NSSEA	National School Supply and Equipment Assoc. 8300 Colesville Rd., No. 250 Silver Spring, MD 20910	(301) 495-0240
NTMA	National Terrazzo and Mosaic Assoc. 3166 Des Plaines Ave., Suite 132 Des Plaines, IL 60018	(708) 635-7744
NWMA	National Woodwork Manufacturers Assoc. (Now NWWDA)	
NWWDA	National Wood Window and Door Assoc. 1400 E. Touhy Ave., #G54 Des Plaines, IL 60018	(708) 299-5200 (800) 223-2301
PATMI	Power Actuated Tool Manufacturers' Institute, Inc. 1000 Fairgrounds Rd., Suite 200 St. Charles, MO 63301	(314) 947-6610
PCA	Portland Cement Assoc. 5420 Old Orchard Rd. Skokie, IL 60077	(708) 966-6200
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604	(312) 786-0300
PDI	Plumbing and Drainage Institute c/o Sol Baker 1106 W. 77th St., South Dr.	

	Indianapolis, IN 46260	(317) 251-6970
PEI	Porcelain Enamel Institute 102 Woodmont Blvd., Suite 360 Nashville, TN 38205	(615) 385-0758
RFCI	Resilient Floor Covering Institute 966 Hungerford Dr., Suite 12-B Rockville, MD 20805	(301) 340-8580
RIS	Redwood Inspection Service 405 Enfrente Dr., Suite 200 Novato, CA 94949	(415) 382-0662
RMA	Rubber Manufacturers Assoc. 1400 K St., NW Washington, DC 20005	(202) 682-4800
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711	(216) 493-7886
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145	(216) 889-0010
SGCC	Safety Glazing Certification Council c/o ETL Testing Laboratories Route 11, Industrial Park Cortland, NY 13045	(607) 753-6711
SHLMA	Southern Hardwood Lumber Manufacturers Assoc. (Now HMA)	
SIGMA	Sealed Insulating Glass Manufacturers Assoc. 401 N. Michigan Ave. Chicago, IL 60611	(312) 644-6610
SJI	Steel Joist Institute 1205 48th Avenue North, Suite A Myrtle Beach, SC 29577	(803) 449-0487
SMA	Screen Manufacturers Assoc. 3950 Lake Shore Dr., Suite 502-A Chicago, IL 60613-3431	(312) 525-2644
SMACNA	Sheet Metal and Air Conditioning Contractors National Assoc. 4201 Lafayette Center Dr. Chantilly, VA 22021	(703) 803-2980
SPIB	Southern Pine Inspection Bureau	

	4709 Scenic Highway Pensacola, FL 32504	(904) 434-2611
SPRI	Single Ply Roofing Institute 20 Walnut St. Wellesley Hills, MA 02181	(617) 237-7879
SSPC	Steel Structures Painting Council 4516 Henry St. Pittsburgh, PA 15213	(412) 687-1113
SSPMA	Sump and Sewage Pump Manufacturers Assoc. P.O. Box 647 Northbrook, IL 60065-0647	(708) 559-9233
STI	Steel Tank Institute 570 Oakwood Rd. Lake Zurich, IL 60047	(708) 438-8265
SWI	Steel Window Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
SWPA	Submersible Wastewater Pump Assoc. 600 S. Federal St., Suite 400 Chicago, IL 60605	(312) 922-6222
TCA	Tile Council of America P.O. Box 326 Princeton, NJ 08542-0326	(609) 921-7050
TIMA	Thermal Insulation Manufacturers Assoc. (This Organization is now defunct. See NAIMA)	
TPI	Truss Plate Institute 583 D'Onofrio Dr., Suite 200 Madison, WI 53719	(608) 833-5900
UL	Underwriters Laboratories 333 Pfingsten Rd. Northbrook, IL 60062	(708) 272-8800
UNI	Uni-Bel PVC Pipe Assoc. 2655 Villa Creek Dr., Suite 155 Dallas, TX 75234	(214) 243-3902
USP	U.S. Pharmacopoeial Convention 12601 Twinbrook Parkway Rockville, MD 20852	(301) 881-0666

WA	Wallcoverings Assoc. 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6618
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281	(503) 639-0651
WCMA	Window Covering Manufacturers Assoc. 355 Lexington Ave., 17th Floor New York, NY 10017	(212) 661-4261
WIC	Woodwork Institute of California P.O. Box 11428 Fresno, CA 93773-1428	(209) 233-9035
WLPDIA	Western Lath, Plaster, Drywall Industries Assoc. (Formerly California Lath & Plaster Assoc.) 8635 Navajo Rd. San Diego, CA 92119	(619) 229-8307
WRI	Wire Reinforcement Institute 1101 Connecticut Ave. NW, Suite 700 Washington, DC 20036-4303	(202) 429-5125
WSC	Water Systems Council 600 S. Federal St., Suite 400 Chicago, IL 60605	(312) 922-6222
WSFI	Wood and Synthetic Flooring Institute 4415 W. Harrison St., Suite 242-C Hillside, IL 60162	(708) 449-2933
WWPA	Western Wood Products Assoc. Yeon Building 522 SW 5th Ave. Portland, OR 97204-2122	(503) 224-3930
WWPA	Woven Wire Products Assoc. 2515 N. Nordica Ave. Chicago, IL 60635	(312) 637-1359

G. Federal Government Agencies: Names and titles of federal government standard- or Specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard- or Specification-producing agencies of the federal government. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

CE	Corps of Engineers (U.S. Department of the Army) Chief of Engineers - Referral Washington, DC 20314	(202) 272-0660
CFR	Code of Federal Regulations	

	(Available from the Government Printing Office) N. Capitol St. between G and H St., NW Washington, DC 20402 (Material is usually first published in the "Federal Register")	(202) 783-3238
CPSC	Consumer Product Safety Commission 5401 Westbard Ave. Bethesda, MD 20207	(800) 638-2772
CS	Commercial Standard (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	(202) 783-3238
DOC	Department of Commerce 14th St. and Constitution Ave., NW Washington, DC 20230	(202) 482-2000
DOT	Department of Transportation 400 Seventh St., SW Washington, DC 20590	(202) 366-4000
EPA	Environmental Protection Agency 401 M St., SW Washington, DC 20460	(202) 382-2090
FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20590	(202) 366-4000
FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554	(202) 632-7000
FDA	Food and Drug Administration 5600 Fishers Lane Rockville, MD 20857	(301) 443-1544
FHA	Federal Housing Administration (U.S. Department of Housing and Urban Development) 451 Seventh St., SW Washington, DC 20201	(202) 708-1422
FS	Federal Specification (from GSA) Specifications Unit (WFSIS) 7th and D St., SW Washington, DC 20407	(202) 708-9205
GSA	General Services Administration F St. and 18th St., NW Washington, DC 20405	(202) 708-5082

MIL	Military Standardization Documents (U.S. Department of Defense) Naval Publications and Forms Center 5801 Tabor Ave. Philadelphia, PA 19120	
NIST	National Institute of Standards and Technology (U.S. Department of Commerce) Gaithersburg, MD 20899	(301) 975-2000
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) 200 Constitution Ave., NW Washington, DC 20210	(202) 219-6091
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	(202) 783-3238
REA	Rural Electrification Administration (U.S. Department of Agriculture) 14th St. and Independence Ave., SW Washington, DC 20250	(202) 447-2791
USDA	U.S. Department of Agriculture Independence Ave. between 12th St. and 14th St., SW Washington, DC 20250	(202) 720-2791
USPS	U.S. Postal Service 475 L'Enfant Plaza, SW Washington, DC 20260-0010	(202) 268-2000

1.5 GOVERNING REGULATIONS AND AUTHORITIES

A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project Site to be available for reference by parties who have a reasonable need.

1.6 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 4200

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SECTION 014500 - QUALITY REQUIREMENTS

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 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 the 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 of 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 restriction 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 the responsible officer of the testing laboratory.
E. Mail reports directly to the 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 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 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 cost 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 representative 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 014500

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SECTION 01 45 33 – SPECIAL INSPECTIONS AND STRUCTURAL TESTING

PART 1.10 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the *Building Code of New York State* (BCNYS).

B. Hold a Special Inspections preconstruction meeting at least 7 days prior to the initial planned date for start of construction.

1. Discussions shall include the following:
   a. Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.
   b. Responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Registered Design Professional.
   c. Notification and reporting procedures.
2. Attendees shall include the Contractor, Construction Manager, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and for Architectural.

1.2 DEFINITIONS

A. Registered Design Professional: The licensed Professional Engineer or Registered Architect whose seal appears on the Construction Drawings. Unless noted otherwise, references to the Registered Design Professional in this section refer to the Structural Engineer for the building design.

B. Code Enforcement Official: The Officer or other designated authority charged with administration and enforcement of the BCNYS. For project under the jurisdiction of New York State agencies such as the Department of Education (SED), State University Construction Fund (SUCF), Office of General Services (OGS), and Dormitory Authority (DASNY), the Code Enforcement Official is an official from the agency having jurisdiction.

C. Testing/Inspecting Agency: An agent retained by the Special Inspector or by the Owner and coordinated by the Special Inspector, to perform some of the inspection services on behalf of the Special Inspector. (An example of an Inspecting Agent is a Geotechnical Engineer.)

D. Statement of Special Inspections: A document prepared by the Registered Design Professional and filed with and approved by the Code Enforcement Official that includes the Schedule of Special Inspections listing the materials and work requiring Special Inspections. This document includes the inspections and verifications required for the project and the individuals, agencies, and/or firms who will be retained to perform these services.

E. Continuous Special Inspection: The full-time observation of work by the Special Inspector or Testing Agency while the work is being performed.

F. Periodic Special Inspections: The part-time or intermittent observation of work by the Special Inspector or Testing Agency for work that has been or is being performed and at the completion of the work.

1.3 QUALIFICATIONS

A. The Special Inspector and Testing/Inspecting Agency shall be accepted by the Registered Design Professional (RDP) and the Code Enforcement Official.

B. Special Inspections shall be performed by agents who have relevant experience for each category of inspections indicated on the drawings.

C. Minimum qualifications of inspection agents are indicated on the drawings.

1.4 SUBMITTALS

A. The Special Inspector and Testing/Inspecting Agency shall submit to the Registered Design Professional and Code Enforcement Official for review, a copy of their qualifications including the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. The Special Inspector and Testing/Inspecting Agency 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.

1.5 PAYMENT

A. The Owner will engage and pay for the services of the Special Inspector and Testing/Inspecting Agency.

B. If any materials requiring Special Inspections are fabricated in a plant not located within 200 miles of the project site, the Contractor shall be responsible for the travel expenses of the Special Inspector or Testing/Inspecting Agency.

C. The Contractor shall be responsible for the cost of any retesting or reinspection of the work failing to comply with the requirements of the Contract Documents.

1.6 OWNER RESPONSBILITIES

A. The Owner will provide the Special Inspector with a complete set of Contract Documents sealed by the Registered Design Professional and approved by the Code Enforcement Official.

1.7 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Special Inspector and his agents so that Special Inspections and testing may be performed without hindrance.

B. As indicated in the Schedule of Special Inspections, the Contractor shall notify the Special Inspector and/or Testing/Inspecting Agency at least 48 hours in advance of a required inspection or test.

C. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

D. If Special Inspections or testing require the use of the Contractor’s scaffolding to access work areas, the Contractor shall provide a competent person to perform the daily evaluation of the

scaffolding to verify that it is safe to use. The Contractor shall notify the Special Inspector and Testing Agent of this review before each use. The Contractor is responsible for the safe assembly and stability of the scaffolding.

E. The Contractor shall keep the latest set of Construction Drawings, field sketches, accepted shop drawings, and specifications at the project site for field use by the Inspectors and Testing Technicians.

F. The Contractor shall perform remedial work (if required) and sign non-conformance reports stating that remedial work has been completed. The Contractor shall submit signed reports to the Special Inspector as work proceeds.

G. The Special Inspection 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.

H. The Contractor shall be solely responsible for construction site safety.

1.8 LIMITS ON AUTHORITY

A. The Special Inspector or Testing/Inspecting Agency shall not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Special Inspector or Testing/Inspecting Agency shall not have control over the Contractor's means and methods of construction.

C. The Special Inspector or Testing/Inspecting Agency shall not be responsible for construction site safety.

D. The Special Inspector or Testing/Inspecting Agency shall not have the authority to stop the work.

PART 1.20 - INSPECTIONS AND TESTING

1.21 STRUCTURAL EXCAVATION, BACKFILL, COMPACTION, AND SUBGRADE

A. The Special Inspector shall perform inspections and verifications or coordinate the RDP for Geotechnical Engineering to perform inspections and verifications including the following:

1. Identify soils requiring undercutting and replacing while observing proof rolling and when subgrade is exposed.
2. Verify footing bearing strata.
3. Review and accept materials proposed by Contractor for use as compacted fill based on test data and information submitted by the Testing Agency. Material approval shall be based on the requirements and recommendations stated in the Project Geotechnical and Subsurface Investigation.
4. Observe and accept filling and compaction procedures.
5. Observe and accept preparation of slab-on-grade subgrade and subbase.

B. The Testing Agency shall perform field density tests for building subgrades and for fill materials including slab subbase within building area in accordance with ASTM D 1557 or ASTM D 2922 as follows:

1. Footing subgrade and each stratum of soil on which footings will be placed.
2. Building subgrade including slab subbase and each lift of compacted material.
3. Field Area and trenches for utilities: Inspect each subgrade and fill layer before further backfill or construction work is performed. Approval shall be based on satisfactory achievement of compaction criteria.
4. Verify use of fill material and lift thicknesses in field.

C. The Testing Agency shall perform moisture content testing of the slab subbase in accordance with ASTM D 3017.

1.22 CAST-IN-PLACE CONCRETE

A. In addition to the items noted in this section, refer to related specification Section 033000 for additional information.
B. The Special Inspector shall perform the following:

1. Inspect reinforcing steel and placement.
2. Inspect embedded bolts and anchor rods prior to concrete placement.

The Testing Agency shall perform the following:

1. Verify the use of the required design mix.
2. Sample and test concrete during placement as follows (test shall be taken at point of discharge into structure):
   a. Record specific location(s) where the concrete was placed. Refer to column lines where possible.
   b. Record time concrete is batched as shown on truck ticket, time placement begins/sample time, and is time truck is empted.
   c. Sample fresh concrete in accordance with ASTM C 172, except modified for slump to comply with ASTM C 94.
   d. Perform slump test in accordance with ASTM C 143.
   e. Measure air content in accordance with ASTM C 231, pressure method, one for each truckload of ready-mixed concrete (air-entrained or non-air-entrained).
   f. Record temperature of concrete for each truck. Test in-place concrete temperature hourly when ambient temperature is 40 degrees F and below and when 80 degrees F and above.
   g. Record air temperature and general weather conditions (cloudy, windy, sunny, etc.).
   h. Record unit weight of fresh normal-weight concrete in accordance with ASTM C 138.
   i. Perform concrete compressive tests as follows:
      I. Prepare compressive test specimens in accordance with ASTM C 31. Store undisturbed in an insulated box during cold weather. Deliver to laboratory between 16 and 32 hours after making. Perform compressive tests in accordance with ASTM C 39: two specimens tested at 7 days, two specimens tested at 28 days, and two specimens retained in reserve for later testing if required.
      II. In cold weather or whenever steel erection is scheduled to commence less than 14 days after placement of supporting foundation concrete, cast an additional set of four cylinders for each 50 cubic yards or fraction thereof of supporting foundation concrete. Field cure cylinders and test two specimens at 7 days, retaining two

specimens in reserve for later testing if required. Steel erection may not begin until supporting concrete obtains 75 percent of its design strength.

III. If concrete will be placed in separate buildings on a given project, individual compressive strength tests cylinder shall be made for each building.

j. Perform additional testing as follows if required:

I. Take an additional set of cylinders for compressive strength testing for each truck in which the total time period between batching and completion of placement has exceeded the ACI recommended 90-minute-maximum time limit and is likely to exceed 120 minutes. Additional cylinders shall be taken within 10 minutes of placement completion.

II. Make additional tests of in-place concrete when test results indicate specified concrete strengths and/or other characteristics have not been attained in the structure.

III. Perform tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods acceptable to Architect.

IV. Contractor shall reimburse Owner for the costs of additional tests.

3. Check formwork for shape, location, and dimensions of the formed member.
4. Inspect concrete and shotcrete placement for proper application techniques.
5. Inspect for maintenance of specified curing temperature and techniques.
6. Perform Floor Flatness (F_F) and Levelness (F_L) Testing no later than 48 hours after slab placement in accordance with ASTM E 1155. (F_L) testing is not required for slabs on metal deck.
7. Perform moisture vapor emission and alkalinity testing in accordance with ASTM F 1869 and ASTM F 710 respectively as follows:
   a. Perform testing after building is enclosed, prior to installation of adhered floor finishes, and once HVAC systems are operational.
   b. Test results must be reviewed and accepted by the floor finish installer.
8. Verify in-situ concrete strength prior to removal of shores/forms from beams or structural slabs.
9. Inspect welding of reinforcing bars.
10. Inspect anchors post-installed in hardened concrete members.

1.24 STRUCTURAL STEEL (INCLUDING STEEL JOISTS, AND METAL DECK)

A. In addition to the items noted in this section, refer to related specification Sections 051200, 052100, and 053100 for additional information.

B. The Special Inspector shall perform the following:

1. Verify that the Fabricator maintains detailed fabrication and Quality Control procedures:
   a. Review procedures for completeness and adequacy relative to code requirements.
   b. If Fabricator is designated as an AISC Certified Fabricator, Special Inspection for shop-fabricated members and assemblies is not required.
   c. If Fabricator is not designated as an AISC Certified Fabricator, the Contractor shall reimburse the Owner via execution of a credit change order for the cost of Special Inspections and Testing in the Fabricator's shop.
2. Review Manufacturer's Certificates of Compliance for high strength bolts and weld filler material.
3. Review certified mill test reports.
4. Inspect steel frame joint details for compliance with the approved Construction Documents.

C. The Testing Agency shall perform the following:

1. Material verification of high-strength bolts, nuts, and washers (including review of identification markings and Manufacturer's Certificate of Compliance).
   a. Test high-strength bolt assemblies in a tension measuring device to verify material conformance prior to installation. Assemble bolt, nut, and washer on a loose plate and tension by tightening the nut to develop the required tension in Table 4 of the "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Verification that copies of accepted field welding procedure specifications are available on site for reference by the erector's welders.
3. Verification that the erector's welder's qualifications are current and are appropriate for the joint type, welding position and welding process to be used.
4. Verification that joint fit up for partial and complete penetration groove welds are in compliance with AWS tolerances as follows:
   a. Visually inspect 100% of all joints scheduled for partial and complete penetration groove welds.
   b. Visually inspect 100% of all column splices scheduled for partial and complete penetration groove welds.
   c. Visually inspect 100% of all tension member splices, column splices and moment connections that are part of the lateral force resisting system.
5. Inspect high-strength bolting.
   a. Joints designated as snug-tight require only visual inspection.
   b. Joints designated as slip-critical require visual inspection during installation.
   c. Checking only after installation using calibrated wrenches will not be permitted in lieu of inspection noted in 5b.
6. Material verification of structural steel and metal deck, including review of identification markings.
7. Perform pull-out tests on adhesive, expansion, and sleeve anchors.
8. Material verification of weld filler materials, including review of identification markings.
9. Inspect welding of structural steel and metal deck.
   a. Visually inspect all welds according to AWS.
   b. Schedule inspection of field welding in a timely manner utilizing vertical access means and methods utilized by the Contractor to perform the welding.
   c. Ultrasonic inspection (UT) according to ASTM E 587 is required for partial and complete penetration field groove welds as follows:
      1. UT inspect 100% of all joints scheduled for partial and complete penetration groove welds.
      2. UT inspect 100% of all column splices scheduled for partial and complete penetration groove welds.
      3. UT inspect 100% of all tension member splices, column splices and moment connections that are part of the lateral force resisting system.

   d. Magnetic particle inspection according to ASTM E 709 is required for Fabricators not certified by the AISC Quality Certification Program for 15 percent of randomly-selected shop fillet welds.
   e. Magnetic particle inspection according to ASTM E 709 is required for 15 percent of randomly-selected field fillet welds.
   f. Ultrasonic inspection according to ASTM E 587 is required for 100 percent of shop partial or complete penetration welds and 100% of shop partial or complete penetration groove welds in tension members.
   g. Inspect shear connectors in accordance with AWS D1.1, Section 7. Observe bend tests performed by Contractor.
   h. Inspect every shear connector by striking once with 10-pound hammer. Direction of hammer swing shall be parallel with member containing connector. Inspection by striking with hammer does not replace bend tests in accordance with AWS.

10. Inspect welding of reinforcing steel.
11. Inspect condition of erected materials.
    a. Visually inspect erected steel for damage.
    b. Visually inspect connections and framing to verify compliance with the Contract Documents and accepted shop drawings.
12. Inspect column plumbness and splices:
    a. Inspect erected columns for plumbness within tolerances specified in AISC Code of Standard Practice, Section 7.13.
    b. Inspect columns for fit-up within tolerances specified in the AISC *Manual of Steel Construction*, Specification Section M4.
13. Inspect mechanical fasteners for metal deck including connections to supporting structure and side lap fastening.
14. Additional testing shall be performed as follows if required:
    a. Testing Agency shall perform additional tests of connections and framing members that have been field modified by the Contractor to correct errors in shop drawings, fabrication, or erection.
    b. Anchor rods and embedded structural supports incorrectly located or damaged after installation shall be field modified by the Contractor as indicated in Section 033000, Paragraph 3.5 and shall be tested by the Testing Agency.
    c. Testing and reporting of field modifications shall be in accordance with this section, Special Inspections, and shall have the following additional requirements:
        I. Magnetic particle inspection according to ASTM E 709 is required for 100 percent of fillet welds.
        II. Ultrasonic inspection according to ASTM E 587 is required for all full-penetration welds.
        III. Perform pull-out tests on 100 percent of each type of adhesive, expansion, or sleeve anchor used by applying a load equal to 125 percent of the allowable pull-out strength listed in the manufacturer's literature.
    d. The Contractor shall reimburse the Owner for the costs of additional tests performed and any other additional testing required.

1.25 COLD-FORMED METAL FRAMING

A. The Special Inspector shall perform the following:

1. Verify that the Fabricator maintains detailed fabrication and Quality Control procedures:
    a. For Fabricators not previously registered and approved to perform such work without Special Inspection, review the Quality Control procedures for completeness and adequacy relative to the code requirements for the Fabricator's scope of work.
2. Visually inspect installation of clips, hangers, hurricane ties, and miscellaneous other connectors.
3. Visually inspect framing and details.
4. Visually inspect installation of truss bracing.

B. The Testing Agent shall perform the following:

1. Verify member sizes and thickness.
2. Verify weight of galvanized coating according to ASTM A 90.
3. Visually inspect framing for damage, including trusses and bracing.
4. Visually inspect welds according to AWS.
5. Perform pull-out tests on adhesive, expansion, and sleeve anchors.

1.26 MASONRY VENEERS AND ARCHITECTURAL WALL PANELS

A. The Special Inspector shall perform the following:

1. As masonry construction begins, the following shall be verified to ensure compliance:
   a. Construction of mortar joints.
   b. Location of joint reinforcement and connectors.
   c. Prestressed masonry:
      I. Location, grade, and size of prestressing tendons and anchorage.
      II. Prestressing technique.
2. Verify:
   a. Size and location of structural elements.
   b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
   c. Specified size, grade, and type of reinforcement.
   d. Protection of masonry during cold weather (temperature below 40˚F) or hot weather (temperature above 90˚F).
3. Prior to grouting, verify:
   a. Grout space is clean.
   b. Placement of reinforcement and connectors.
   c. Placement of prestressing tendons and anchorages.
   d. Construction of mortar joints.
4. Verify grout placement to ensure compliance with code and Construction Document Provisions.
   a. Grout of CMU cells.
   b. Grouting of prestressed bonded tendons.

B. The Testing Agency shall perform the following:

1. Verify for compliance with approved submittals:
   a. Proportions of site-prepared mortar.
   b. Proportions of site-prepared grout including prestressing grout for bonded tendons.
2. Inspect:
   a. Welding of reinforcing bars.
   b. Application of measurement of prestressing force.
3. Observe preparation of any required grout specimens, mortar specimens, and/or prisms in accordance with ASTM C 780, ASTM C 1019, and ASTM C 1314 REV B.
4. Field Quality Control Testing: Perform tests and evaluations listed below during construction for each 5,000 sq. ft. of wall area or portion thereof.
   a. Sample and evaluate mortar composition and properties in accordance with ASTM C 780.
   b. Sample and test grout compressive strength in accordance with ASTM C 1019.
   c. For each type of wall construction indicated, test masonry prisms in accordance with ASTM C 1314 and as follows:
      I. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

1.27 SPRAY FIRE-RESISTANT MATERIALS

A. The Special Inspector/Testing Agency shall perform the following:

1. Verify surface preparation in accordance with the manufacturer’s written instructions.

2. Verify temperature and area ventilation before and after application in accordance with manufacturer's written instructions.
3. Verify thickness of sprayed fire-resistant materials.
4. Verify density of sprayed fire-resistant materials.
5. Verify cohesive/adhesive bond strength of sprayed fire-resistant materials.

1.28 SMOKE CONTROL

A. Smoke control systems shall be tested by the Special Inspector. The Special Inspector/Testing Agency shall perform the following:

1. Perform leakage testing and verify recording device location during erection of ductwork and prior to concealment
2. Perform pressure difference testing, flow measurements and detection, and verify control operations prior to occupancy and after sufficient completion.

PART 1.30 – DOCUMENTATION

1.31 RECORDS AND REPORTS

A. Detailed reports shall be prepared of each test or inspection. The reports shall include the following general information:

1. Project name and number.
2. Date of test or inspection.
3. Name of Testing Agency or Inspecting Agency.
4. Name of technician or inspector.
5. Weather conditions.
6. Locations and elevations of specific areas tested or inspected referenced to gridlines.
7. Description of test or inspection.
8. Reference to approved shop drawing and/or applicable construction document.
8. Reference to applicable ASTM standard.
9. Summary of observations, results, and recommendations.
10. Description of any areas or materials requiring retesting or reinspection.

B. Concrete compressive strength test reports shall contain the following information:

1. Name of Contractor and concrete supplier.
2. Name of concrete testing service.
3. Name of technician making and testing specimens.
4. Truck number and delivery ticket number.
5. Date and location within the structure of concrete placement.
6. Concrete type, class, mix proportions of materials, and design compressive strength at 28 days.
7. Slump, air content, unit weight, and concrete temperature.
8. Total time period between batching and completion of placement for each truck.
9. Compressive strength and type of break for all tests.

C. Field reports for concrete inspection shall contain the general information noted above, plus ambient temperature and cylinder numbers.

D. Test reports for masonry materials shall include proportions, composition, and compressive strength.

1.32 COMMUNICATION

A. The Testing/Inspecting Agency shall immediately notify the Contractor, Special Inspector, and Registered Design Professional by telephone, fax, or email of any test results failing to comply with the requirements of the Contract Documents.

B. The Special Inspector shall immediately notify the Contractor of any work found to be in nonconformance with the Contract Documents during inspections. If the nonconforming work is not corrected while the Special Inspector is on-site, the Special Inspector shall notify the Registered Design Professional within 24 hours (one business day) and issue a nonconformance report. The Special Inspector may use the Special Inspection Non-Conformance Report form at the end of this section or other similar form.

C. If the nonconforming work is not corrected at the time of substantial completion of the structure or other appropriate time, the Special Inspector shall notify the Code Enforcement Official.

1.33 DISTRIBUTION OF REPORTS

A. The Testing/Inspecting Agency shall submit reports to the Special Inspector and the Registered Design Professional within 7 days of the inspection or test. Legible handwritten reports may be submitted if final typed copies are not available.

B. The Special Inspector shall submit reports to the Registered Design Professional within 7 days of the inspections. Legible handwritten reports may be submitted if final typed copies are not available.

C. If requested by the Code Enforcement Official, the Special Inspector shall submit interim reports which include all inspections and tests performed since the beginning of construction or since the previous interim report. Interim reports shall be addressed to the Code Enforcement Official with copies sent to the Registered Design Professionals (Structural Engineer and Architect) and Contractor. Interim reports shall be signed by the agent performing inspections.

1.34 FINAL REPORT OF SPECIAL INSPECTIONS

A. At the completion of work, each Testing/Inspecting Agency shall submit an Agent's Final Report of Special Inspections to the Special Inspector stating that work was completed in substantial conformance with the Contract Documents and that appropriate inspections and tests were performed. The Testing/Inspecting Agency may use the Agent's Final Report of Special Inspections form provided at the end of this section or other similar form.

B. At the completion of work, the Special Inspector shall compile all inspection and test reports generated by each Agent into a Final Report of Special Inspections. The Final Report of Special Inspections shall state that required inspections have been performed and shall itemize any nonconforming work not corrected or resolved.

C. The Special Inspector may use the Final Report of Special Inspections form based on CASE Form 102-2001 or other similar form.

D. The Special Inspector shall submit The Final Report of Special Inspections to the Registered Design Professional and Code Enforcement Official prior to issuance of a Certificate of Use and Occupancy

END OF SECTION 01 45 33

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NYS EDUCATION DEPARTMENT **Office of Facilities Planning** **89 Washington Avenue, Room 1060 EBA** **Albany, NY 12234**	**STATEMENT OF SPECIAL INSPECTIONS AND TESTS** As required by the Building Code of NYS (2020 BCNYS) *Note: The code listings below are not to be considered all inclusive.*

BCNYS § 1704.2.3 requires the NYS Licensed Design Professional (of record) to complete the Statement of Special Inspections and Tests. Completion of the Statement of Special Inspections & Tests, **and;** Submission to the Office of Facilities Planning with the Construction Permit Application is a condition for issuance of the Building Permit.

School District	Project Tiltle
ROCKLAND BOCES	ROCKLAND BOCES PTECH-CTEC BUILDING
Building	
PTECH-CTEC	
SED Project #	Project Address
509000-00-0044-001	65 Parrott Road, West Nyack, NY 10994
Architect/Engineer:	
Sign and Stamp: REGISTERED ARCHITECT ARMAND SAMUEL QUADRINI 022313 STATE OF NEW YORK	
A/E Firm (or Dba):	Phone / Date
GACE Consulting Engineers DPC - Alyson Sikorski, PE KSQ Design- Armand Quadrini	212-545-7878 914-893-5639 6/30/2025
Comments:	

INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS- CHAPTER 17** **All reports to be submitted to the owners representative for use, approval and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
A. Steel Construction				**Ch. 22**		
1. Material verification of high-strength bolts, nuts and washers.		X	AISC 360	1705.2 2204	☑	
2. Inspection of high-strength bolting.	X	X	AISC 360 ACI 318	1705.2 2204.2	☑	
3. Material verification of **Structural Steel**. **Open Web Steel Joist and Girders.** Basic protection of steel members, **Seismic Resistance**			AISC 360 ASTM A6, A514, A29 SJ100, 200 AICS 341	1705.2 2203, 2205 1705.2 2207	☑ ☑ ☐	
4. Spray Applied Fire Resistant Materials & Specialized Finishes			ASTM E605, E736	1705.14 1705.15	☐	
5. **Cold Formed Steel Construction**- load bearing. **Seismic Resistance**			AISI S100, S220, S240 ANSI/SDI -NC1.0, RD1.0, SDI-C, ASCE 7, 8 AISI S400	1704.2.5 2210 2211	☐ ☐	
6. Material verification of weld filler materials.			AWS D1.1, D1.3	1705.2 2204.1	☑	
7. Inspection of welding:			ACI 318: 26.6.4	T 1705.3 2204	☑	
a. Structural steel	X	X	AWS D1.1, D1.3	1705.2	☑	
b. Reinforcing steel	X	X	AWS D1.1, D1.3	1705.3.1	☐	
c. Cold Formed Steel Deck			AISC S100, ASCE 7, 8	1705.2.2	☑	
8. Inspection of steel frame joint details.		X		1705.2	☑	

INSPECTION AND TESTING Continuous & Periodic is as Defined by the BCNYS- CHAPTER 17 All reports to be submitted to the owners representative for use, approval and record.	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
B. Concrete Construction				**Ch. 19**		
1. Inspection of reinforcing steel, including prestressing tendons, and verify placement.		X	Ch. 21, 22 ACI 318; Ch 20, 25.2, 25.3, 26.6.1, 26.6.3 AISC 360	T 1705.3 1901 1905	☑	
2. Inspection of reinforcing steel bar welding.			ACI 318, AWS D1.4	T 1705.3	☐	
3. Inspection of anchors to be installed in concrete prior to and during placement.	X		ACI 318: 17.8.2, 17.8.2.4	T 1705.3	☑	
4. Verify use of required design mix.		X	ACI 318: Ch. 19, 26.4.3, 26.4.4	T 1705.3 1904 1908	☑	
5. Sampling fresh concrete: slump, air content, temperature, strength test specimens.	X		ASTM C172, C31 ACI 318: 26.5, 26.9, 26.10, 26.11	T 1705.3 1901 1905 1908	☑	
6. Inspection of placement for proper application techniques.	X		ACI 318: 26.5	T 1705.3	☑	
7. Inspection for maintenance of specified curing temperature and techniques.		X	ACI 318: 26.5	T 1705.3 1908 1909	☑	
8. Inspection of prestressed concrete.	X		ACI 318: 26.10	T 1705.3	☐	
9. Erection of precast concrete members.		X	ACI 318: 26.9	T 1705.3	☐	
10. Verification of in-situ concrete strength prior to stressing of tendons and prior to removal of shores and forms from beams and slabs.		X	ACI 318: 26.11.2	T 1705.3	☐	
11 Inspection of formwork		X	ACI 318: 26.11.1.2 (b)	T 1705.3	☑	

C. Masonry Construction						Ch. 21
INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS- CHAPTER 17** **All reports to be submitted to the owners representative for use, approval and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**		**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
L1 = Level 1 Inspection required for nonessential facilities. **L2 =** Level 2 Inspection required for essential facilities. * In general, schools are not considered essential facilities unless they are a designated emergency shelter.			ASTM E119 UL 263 ASTM C1364 ASTM C1670 ASTM A706 ASCE 7, 8	TMS 402, 403, 404, 504, 602	1705.4 2101 1604		
1. Verify to ensure compliance:							
a. Proportions of site prepared mortar and grout.		**X L1 & L2**			1705.4 2103.2	☑	
b. Placement of masonry units and construction of mortar joints.		**X L1 & L2**			1705.4 T 1705.3	☑	
c. Location and placement of reinforcement, connectors, tendons, anchorages.		**X L1 & L2**			1705.45 2103.4 T 1705.3	☑	
d. Prestressing technique.		**X L1**			1705.4	☐	
Grout space prior to grouting.	**X L2**				1705.4	☐	
e. Grade and size of prestressing tendons and anchorages.		**X L1**			1705.4	☐	
Placement of grout.	**X L2**				1705.4	☐	
f. Grout specs prior to grouting.	**X L2**				1705.4	☑	
2. Inspection program shall verify:							
a. Size and location of structural elements.		**X L1 & L2**			1704.5 1705.4	☑	
b. Type, size, and location of anchors.	**X L2**	**X L1**			1705.4 T 1705.3	☑	
c. Specified size, grade, and type of reinforcement.		**X L1 & L2**			1704.5	☑	
d. Welding of reinforcing bars.	**X L1 & L2**				1704.5	☐	
e. Cold/hot weather protection of masonry construction.		**X L1 & L2**			1704.5, 2104.3, 2104.4	☑	
f. Prestressing force measurement and application.	**X L2**	**X L1**			1704.5	☐	
3. Verification accessory placement prior to grouting:	**X L2**	**X L1**			1704.5, 2105.2.2, 2105.3	☑	
4. Grout placement.	**X L1**				1704.5	☑	
5. Preparation of grout specimens, mortar specimens, and/or prisms.	**X L1 & L2**				1704.5, 2105.2.2, 2105.3	☑	
6. Compliance with documents and submittals.		**X L1 & L2**			1704.5	☑	

INSPECTION AND TESTING Continuous & Periodic is as Defined by the BCNYS- CHAPTER 17 All reports to be submitted to the owners representative for use, approval and record.	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
D. Wood Construction				**Ch. 23**		
1. Fabrication process of prefabricated **Wood Structural Elements** and assemblies.		X	Ch. 16 AWC, APA, CPA, DOC PS1, PS2	1704.6, 1705.5 2302, 2303 2304	☐	
2. High-load diaphrams **Seismic Resistance**		X		1704, 1705, 1704.6 2304, 2305 2306, 2307, 2308	☐	
E. Soils				**Ch. 18**		
1. Geotechnical Investigations, Excavations, Grading, Fill Damp-proofing/ Water-Proofing		X	ASTM, NYS DOT OSHA Appendix J- BCNYS	1704, 1706 1803, 1804, 1805	☑	
2. **Flood & Stormwater Hazards** [per BCNYS 106]		X	Local Highway Authority Flood Plain Admin. Appendix G- BCNYS	1703 1610, 1611, 1612 1805.1.2.1	☐ ☐	
F. Specialized Foundations- Piers, Piles				**Ch. 16**		
1. Deep Foundation Elements: Driven Piles Cast in Place Helical Piles		X		T 1705.7 T 1705.8 1705.7 1705.8 1705.9	☐	
G. Exterior Wall Coverings				**Ch. 14**		
1. Exterior Insulation and Finish Systems (EIFS) MCM, HPL, Other Combustible Materials		X	ASTM E2568, E2273, E2570 E2393, E84 Ch. 16 NFPA 268, 275, 285, 286	1405, 1406, 1407, 1408 1704.2, 1705.12.5 1705.16	☐	
H. Misc.						
1. Access Floors and Storage Racks Other Architectural, MEP Components **Seismic Resitance**		X		1705.12	☐	
2. In-Situ Testing		X		1604.6, 1708	☐	
3. Pre-Construction Load Testing		X		1604.7, 1709	☐	
4. Fire Resistant Penitrations & Joints Fire Stops Testing for Smoke Control		X	Ch. 7 ASTM E119 UL 263	1705.17 1705.18	☑	
5. **Pre-Submission:** **Inventory of all Fire-Resistant-Rated Construction- Level 2 Alterations and greater** [per BCNYS 106]	X		verification required EBCNYS Ch. 3 C. of E. 155 Regulations.	**FCNYS 701.6** **BCNYS 703.7** **19CRR-NY XXXII**	☐	
6. **Pre-Submission:** **Hazardous Material Survey** **Water Quality Survey**	X X		verification required ACM Letter- Certificate C. of E. 155 Regulations.	US-EPA NYS-DOH	☐	
7. Other: Fabricated Items				1705.10	☑	In accordance with 1704.2.5

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Sewers / septic and drainage.
2. Water Service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Ventilation.
5. Electric power service.
6. Lighting.
7. Temporary Heating.

C. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Site enclosure fence.
5. Security enclosure and lockup.
6. Barricades, warning signs, and lights.
7. Covered walkways
8. Temporary enclosures.
9. Temporary partitions.
10. Fire protection.

D. Unless work of this section is indicated to be provided under a specific contract, Contractor must provide, maintain and remove required temporary facilities necessary to perform his own construction activities.

E. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.2 QUALITY ASSURANCE

A. 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.
6. NYS SED 155.5

B. 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.”

1. 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.”

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.3 PROJECT CONDITIONS

A. Temporary Utilities: 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.

B. 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

A. General: These Specifications assign the Contractor responsibilities.

B. 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. Its own storage, Conex boxes and fabrication sheds. (Locate / Move as directed by CM)
4. 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)
5. Collection and disposal of its own hazardous, dangerous, unsanitary, and all waste material.
6. Secure lock-up of its own tools, materials and equipment.
7. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

8. Maintaining temporary facilities provided by Contractor.
9. Complying with the regulations of the Commissioner of Education - 8 NYCRR 155.5 - Uniform Safety Standards for School Construction and Maintenance Projects specified in Division 1 Section “01 50 00 – Uniform Safety Standards for School Construction.”
10. Containers for non-hazardous waste and debris generated by their own demolition and construction operations.

1.5 USE CHARGES

A. 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.

B. Water Service: Use water from the Owner’s existing water system without metering and without payment of use charges. Access to water shall be approved by the Owner
1. Provide backflow preventer at hydrant for temporary water service. Contractor to include costs for permitting along with use charges associated.

C. Electric Power Service: Temporary electric power including set-up and maintenance is the responsibility of the **Electrical Contractor**. Use charges by Contractor for separate temporary service

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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.

B. 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.

C. Paint: Paint surfaces exposed to view from Owner occupied areas.

D. 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.

E. Temporary Roofing – minimum ½” gypsum sheeting and 30 mil reinforced EPDM membrane.

2.2 EQUIPMENT

A. 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.

B. 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

A. 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.

B. 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, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

3.2 CONTRACTOR FIELD OFFICES

A. Contractor may with permission from the architect and 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 owner and architect 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. (No field offices or storage trailers will be allowed by the buildings.)

B. Maintain, in the contractor’s field office, 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

A. The Contractor’s use of any permanent system or service of the building or portions thereof shall be subject to the Owners approval.

B. 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.

C. NOTE - In accordance with OSHA and other applicable regulations, the representative Contractors performing erection of “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

A. 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. Applicability: This section applies to all renovation and new construction work areas for this Project.
3. Electrical Contractor shall make arrangements with utility company for temporary and permanent services immediately after award of contract.
4. Temporary or permanent 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.
5. **Electrical Contractor shall maintain all parts of the electrical system (temporary and permanent) active and in-service at all times throughout the contract duration.** All temporary lighting to be controlled by standard switches per code (outside of power panels).
6. **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, communication, information technology, kitchen freezers/coolers, heating units, etc). Contractor shall assume a minimum 300 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.
7. Electrical Contractor shall maintain power during the hours established by Construction Manager.
8. 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
9. Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.
10. 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.
11. 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.
12. Provide overload-protected disconnect switch as required by code.

13. For power hand tools and task lighting, provide temporary 4-gang outlets at each floor level, spaced so that a 100 foot extension cord can reach each work area. Provide separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).

14. Maintaining all existing systems, including but not limited to, power, lighting, fire alarm, intercom, etc., within the existing building operational at all times for Owner occupancy and construction.

B. TEMPORARY ELECTRICAL AND TELEPHONE SERVICES

1. Temporary Power Source: Provide temporary electrical service at locations shown on the “staging and logistics plan” located at the end of this specification. Remove temporary services once project is completed.

2. Owner's Requirements: Do not disrupt the Owner's needs for continuous power at each building.

3. 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.

4. Electrical Contractor will include in their base bid: Construction Manager trailer Connect and Disconnection at the staging area: Power and Internet Connection 20 days after notification by CM. Lines will be run in conduit below grade and/or install 15’ tall utility poles as necessary.

5. All other contractor trailer use / connection charges for power and telephone to be paid for by the respective contractor.

C. RECEPTACLE REQUIREMENTS

1. 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.

2. 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.

D. LIGHTING REQUIREMENTS

1. General Requirements: Electrical Contractor shall provide both interior and exterior lighting at areas where existing lighting has been removed and at new construction areas, as required to provide adequate illumination for safe and proper construction operations and Project Site security.

2. 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.

3. Stairways: Provide one 200 watt lamp per landing at each stairway and covered walkway.

4. 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.

5. Restrictions: Do not use permanent lighting systems for temporary construction lighting purposes.

E. MAXIMUM LOADS

1. 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.		
b.	120 volt, 1-phase	1.5 KVA
c.	208 volt, 1-phase	2.5 KVA
d.	208 volt, 3-phase	5.0 KVA

2. 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.

F. ELECTRICAL WELDERS

1. 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.

G. ELECTRICAL ENERGY COSTS

1. 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

A. 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.

B. Responsibilities: The **General Work Contractor** is responsible for temporary sanitary facilities and their maintenance, cleaning and supplies for use by all trades. Sufficient quantity/locations to properly handle the number of workers onsite.

C. 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.

D. Provide separate toilet facilities for male and female construction personnel.

E. Provide separate toilet facilities for Construction Manager personnel located at direction of Construction Manager.

3.6 TEMPORARY HEATING

A. The **Mechanical Work Contractor** will maintain 60 degree temperature in all areas via temporary systems. The Mechanical Contractor will submit a detailed plan including sketches indicating proposed temporary heating system for approval within 4 weeks of

contract award. The **Electrical Work Contractor** will provide temporary power for Mechanical Contractor's units for temporary heating. The fuel, equipment, materials, operating personnel and methods used therefore shall be at all times satisfactory to the Architect and 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. **Timing of requirement for Temporary Heading is specifically noted in the Milestone schedule 01 1100**. **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.).

B. 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.

C. The maintenance of proper heating, ventilation and adequate drying out of the work is the responsibility of the contractor and any work damaged by dampness, insufficient or abnormal heating, shall be replaced to the satisfaction of the Architect by and at the sole expense of the contractor.

D. 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 65 degrees F. Coordinate with Division 9 of the Technical Specifications.

3.7 TEMPORARY WATER

A. The Plumbing Work Contractor shall:

1. Provide and maintain a temporary water system of size and capacity as required below to supply the needs of all Contractors for the work.
2. Provide no less than two 3/4 inch hose bibs conveniently located at each building wing.
3. Provide and pay for all connections and permits.
4. Protect temporary and permanent lines against any damage.
5. Water source is only available from building. If contractor decides distance is too far he should use water storage tanks or struck at no additional charge to the owner.

B. Each Contractor shall:

1. 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.
2. Prevent water damage to the work.

3.8 STORAGE FACILITIES

A. Each Contractor shall provide temporary storage shanties, tool houses 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.

B. 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.

C. 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

A. 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.

B. **The General Work Contractor** is responsible for all Scaffolding, Egress Bridging, Egress Canopies and Protections as per the attached sketches. Fabric type material fall protection should bridge from the existing building to the scaffolding and run down the face of the building. The Fabric type material fall protection will aid in protecting the existing building facade and create a visual barrier between the work area and the occupied school.

3.10 RUBBISH CONTAINER

A. Each Contractor shall provide suitable rubbish container device(s) for their own use (both demolition and construction debris), 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.

B. 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

A. Construction fencing and barriers shall be provided by the **General Work Contractor**, enclosing all work and storage areas as outlined in staging plan at the end of this section and specified within. Temporary construction fencing shall be of good quality and neat in appearance; 6’ high chain link fencing, 9 ga fabric on stanchions with vision barrier screening fabric securely fastened. (Post driven installation where approved by CM) 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)

B. Site access gates shall be provided as required, complete with all operating hardware and security devices.

C. 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.

D. **In addition to any fencing indicated on drawings the General Work Contractor will provide** fencing/staging in parking lot locations as designated by owner and CM. (match specifications above, stanchion-type). Provide 50’ x 100’ (300’ total) enclosed staging area(s) with 16’ wide gates, for use by all trades. Provide a separate line item for this work on the Schedule of Values

3.12 JANITORIAL SERVICE/DAILY CLEANUP

A. Contractor shall furnish daily janitorial services for the project and perform any required maintenance of facilities as deemed necessary by the Architect and 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 Work Contractor** shall provide a daily sweep and a weekly damp mop of all work areas.

3.13 BURNING

A. Burning will not be permitted.

3.14 FIRE PREVENTION CONTROL

A. 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

A. 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.

B. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.

C. 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.

D. Each Contractor shall comply with the following requirements relating to compressed gas:

1. 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.

2. 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.

E. Each Contractor shall comply with the following requirements relating to welding and cutting:

1. All cutting and/or welding (electric or gas) must be done only by skilled, certified and licensed personnel.

2. During welding or cutting operations, a contractors man shall act as a fire watcher. The fire watcher shall have proper eye protection and suitable fire fighting equipment including fire

extinguisher (bearing current inspection Certificate), protective gloves and any other equipment deemed necessary.

3. 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.

4. Adequate fire extinguishing equipment shall be maintained at all welding or cutting operations.

3.16 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION:

A. **General Work 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, 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. General Contractor will provide negative air machines of sufficient size/qty to fully ventilate the square footage of work areas and exhaust any dust/fumes through flexible duct hose to exterior top eliminate any orders / smoke.

6. Any contractor whom allows 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 backcharging in order to insure a safe environment.

3.17 TEMPORARY ROADS AND PERMANENT PAVED AREAS :

A. **General Work Contractor** shall construct and maintain temporary road areas adequate to support loads and to withstand exposure to traffic during construction period.

1. Temporary roads/ staging 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. Includes access for delivery through staging area 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.

4. 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 General Contractor will clean roads for debris from building-related activities.

5. Staging Areas:
Temporary parking by construction personnel shall be allowed only in areas so designated.

3.18 DE-WATERING FACILITIES AND DRAINS

A. 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 General Contractor, coordinate with CM.

B. 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.

C. 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.

D. Remove snow and ice as required to minimize accumulations.

3.19 ROOF PROTECTIONS

A. All Contractors shall provide temporary protection on the roof surface when it is necessary for work to take place on completed sections. (Minimum 2” polyiso insulation and plywood)

B. Upon such notification as required in subparagraph A, the Contractor shall assume responsibility for damages, if any, to the roofing system caused by the work of other trades, except that financial liability for any and all damages rests with the offending trade.

3.20 TEMPORARY SITE SAFETY AND DIRECTIONAL SIGNS

A. The **General Work Contractor** shall provide signs as required below. Install signs where required or indicated 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. Provide a separate line item in your schedule of values for this task.

B. 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.

C. Include relocating temporary site safety and directional signs as many times as required or directed.

D. For construction traffic control/flow at entrances/exits, as designated by the Owner (6 required) Large sign 4’ x4’ Orange with Black Letters (“Construction Entrance Only”)

E. To direct visitors (4 required)

F. For construction parking (2 required)

G. To direct deliveries (4 required)

H. Emergency egress only – Construction area (4 required)

I. Per OSHA standards as necessary

J. For “No Smoking” safe work site at multiple locations (12 required)

K. Construction Area – Do Not Enter (30) mount on fence

L. No Trespassing (30) mount on fence

M. A premobilization meeting to establish location and quantities of all signage will be held with 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

A. The **General 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.

3.22 BARRICADES, WARNING SIGNS AND LIGHTS:

A. 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.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-(16-mm-) thick exterior plywood.

3.23 TEMPORARY ENCLOSURES

A. Specifically at the Cafeteria Renovations the **Mechanical Work Contractor** will provide temporary watertight enclosures for protection of construction, from exposure, foul weather and safety for any roof related openings. Close openings in roof deck with load bearing wood framed construction, ¾” plywood and watertight membrane

B. **General Work Contractor** will provide temporary 2” x4” wood framing, 2” polyiso insulation, ½” plywood, and cover with 6 mil plastic; at any open exterior window removal, wall removal, door entrance locations, etc. for weather and security protection at the end of each workday.

C. 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 PARTITIONS and FLOOR PROTECTIONS

A. **General Work 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 / outside, sound batt insulation, exterior sheathing 5/8” plywood , interior sheathing 5/8” gypsum taped/painted where owner occupied. Caulk seal

joints and perimeter to prevent dust migrations. Equip partitions with dustproof doors and security locks.

2. Temporary Floor Protections – Shall be “Ram-Board” Heavy Duty with taped joints or equivalent. Finish Flooring will be fully covered by **General Work Contractor**. Temporary Floor Protections are to be installed immediately after finish flooring installations. Provide a separate line item in your schedule of values for this task.

3.25 SNOW REMOVAL

A. The **General Work Contractor** shall provide snow removal from the staging area and general work area including access/egress to/from the building

3.26 AREAS OF SPECIAL PROTECTION:

A. In the event of an emergency (designated by the sounding of the fire alarm system) all construction activities must immediately cease. Contractor’s work force will evacuate themselves from work areas and remain outside of work areas until the “all clear” is given. No work operations will be tolerated during the evacuation of the building or during an emergency

3.27 ENVIRONMENTAL PROTECTION:

A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.28 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. 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.

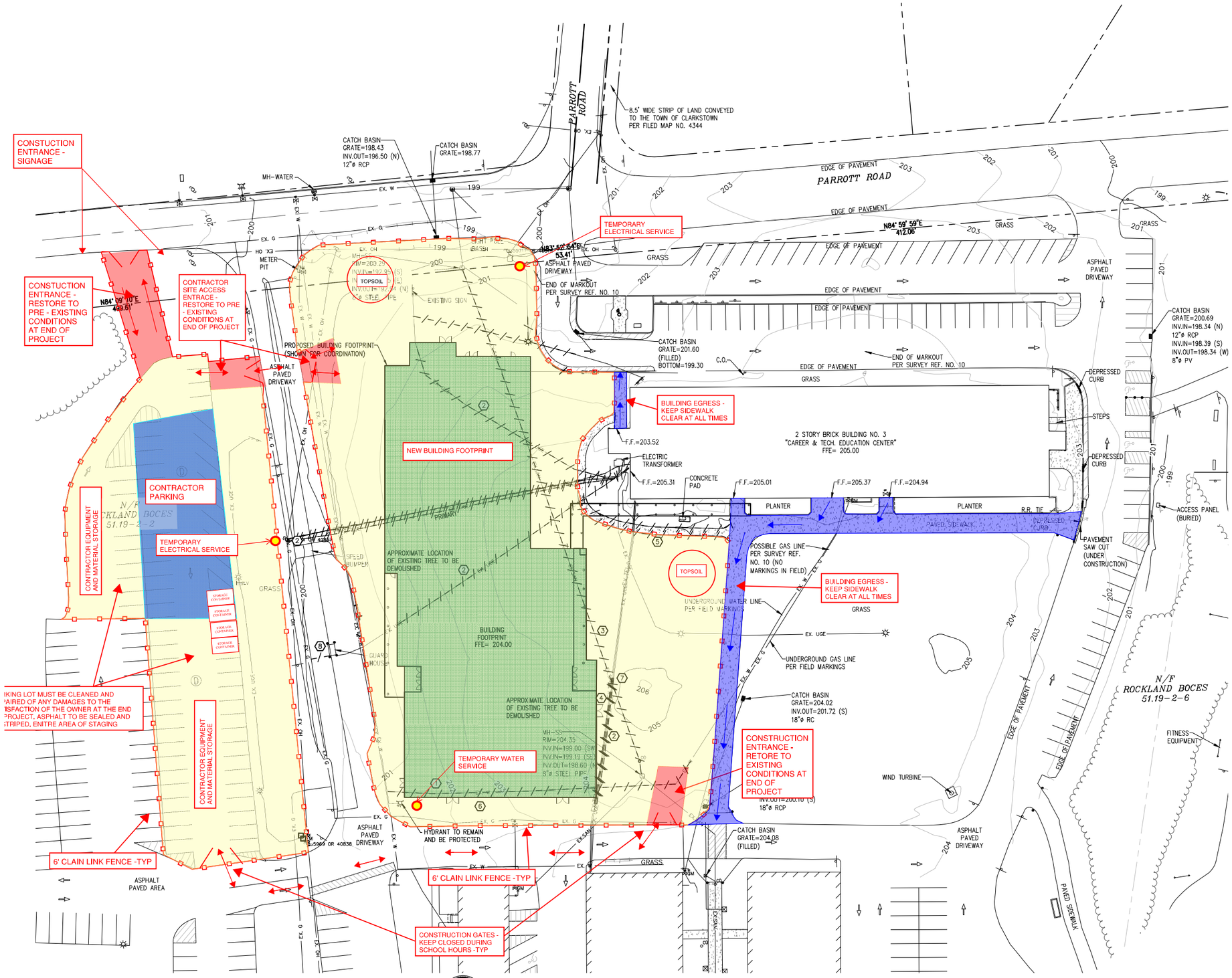
2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including.

3.29 See attached “STAGING AND SITE LOGISTICS PLAN”

END OF SECTION

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STAGING AND SITE LOGISTICS PLAN



DEMO PLAN
1"=30'

SECTION 01 57 13 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including other Division 1 Specification Sections apply to this section.

1.2 SUMMARY

A. This work shall consist of furnishing, installing, maintaining and removing erosion and sediment control measures as shown on the contract documents or as ordered by the Engineer during the life of the contract to control erosion, sediment and water pollution through the use of silt fences. The erosion and sediment control provisions contained herein shall be accomplished to the extent practical to assure economical, effective and continuous erosion, sediment and water pollution control throughout the construction period.

B. Related Sections include the following:
   1. Division 31 Section “Site Clearing.”
   2. Division 31 Section “Earthwork.”
   3. Division 31 Section “Lawns.”
   4. Stormwater Pollution Prevention Plan (SWPPP) Erosion & Sediment Control Only

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless otherwise stated elsewhere in the contract documents, the materials used to construct erosion and sediment control measures shall be as stated herein.

B. Silt Fence: Field constructed silt fence assemblies shall consist of a geotextile (woven type), posts, mesh reinforcement backing, and fasteners. Prefabricated silt fence systems may be used provided that all requirements of this specification are met and they appear on the NYSDOT Approved List under the category of prefabricated silt fence.

   1. Posts: Posts shall meet the following requirements:
      a. Either wood, metal, or synthetic posts may be used. Softwood post shall be 1 ½” x 3 ½”, hardwood post shall be 1 ½” x 1 ½”, steel post shall be “T” or “L” shaped in cross section, with a minimum weight of 1 ½ #/ft.
      b. Posts shall be a minimum of 4’ long.
   2. Mesh Reinforcement: Mesh reinforcement shall be poly-propylene with a maximum ¼” x 2” opening or 14 gauge welded wire mesh with a maximum 4” x 4” opening. Either mesh shall be a minimum 30” wide.
   3. Fasteners: Fasteners shall be heavy duty staples, hog rings, tie wires, or any other fastener compatible with the post material and approved by the engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall comply with all conditions of this Section. Erosion and sediment control measures shall be inspected by the contractor and maintained during the life of the project, including winter shutdown, etc., and such maintenance and inspection shall continue until after the permanent stabilization measures are in place and the disturbed area returned to it's original condition. The remaining disturbed areas shall be permanently stabilized consistent with the adjacent permanently stabilized area.

3.2 WATER QUALITY PROTECTION

A. The Contractor shall protect all water resources within the project limits and take measures to maintain water quality of receiving water bodies. The Contractor shall schedule and conduct the work to minimize erosion and to prevent turbidity in water bodies and sedimentation on lands adjacent to or affected by the work. Construction of erosion and sedimentation control measures, permanent soil stabilization, construction of drainage facilities and performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with related construction operations. The area of unprotected soil exposed at any one time by construction operations shall be kept to a minimum and shall not exceed the limits established in the contract documents or applicable permits.

3.3 AUTHORITY OF WORK

A. The Engineer has the authority to limit the surface area of material exposed by excavation and to direct the Contractor to provide immediate permanent erosion and sediment control measures to minimize damage to adjacent property and to minimize contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment, and wetlands.

3.4 SCHEDULE OF WORK

A. At the preconstruction conference or prior to the start of the applicable construction, the Contractor shall submit schedules for the accomplishment of erosion and sediment control work and permanent soil stabilization work to the Engineer. After receipt of all pertinent information the Engineer, will have three working days to review and approve the submission and reply in writing to the Contractor. The Contractor shall begin work only after receiving written approval from the Engineer.

3.5 AREAS OF WORK

A. The Engineer shall direct the Contractor to limit the area of paving and trenching operations and site work in progress, commensurate with the Contractor's capability and progress in keeping the finish grading and control measures current in accordance with the accepted schedule.

3.6 SILT FENCE

A. Installation: Unless otherwise detailed in the contract documents, the fence shall be installed as follows:

1. Posts shall be driven into the ground, or adequately anchored if in rock.
2. Geotextile and mesh reinforcement shall be placed on the up flow side of the posts.

3. The geotextile shall be attached to each post in no less than 4 locations with approved fasteners.
4. The mesh reinforcement shall be attached to each post at the top, bottom, and two additional evenly spaced locations, or by a continuous corded attachment along the top of the assembly. Attachment is to be made with approved fasteners.
5. Any geotextile or mesh splices necessary for fence erection shall be continuous between two post sections.
6. Geotextile at the bottom of the fence shall be buried in a trench to a depth of 6". The trench shall be backfilled with the excavated soil and the soil compacted by tamping.

B. Care of fence during construction:

1. The Contractor shall continuously maintain the integrity of the silt fence, including providing all necessary labor, equipment and materials, until earthwork construction is completed and permanent erosion control measures are in place. The Contractor shall inspect all temporary silt fence immediately after each storm and at least daily during prolonged rainfall to determine if the structure is functioning as designed. Any deficiencies shall be immediately corrected by the Contractor. Should the silt fence become damaged or otherwise ineffective while the barrier is still necessary, it shall be repaired or replaced promptly as directed by the Engineer.
2. Sediment deposits shall be removed wherever the deposit or debris buildup creates "Breaches" or "Bulges" in the fence or more than 6" of material has accumulated. All sediment deposits shall be considered unsuitable material and disposed of in accordance with Section 02300.
3. The Contractor shall immediately repair or replace defective or damaged portions of the fence assembly. Torn or punctured fabric shall be repaired by the placement of a patch, on the up slope side, consisting of an additional layer of fabric over the damaged area.
4. Maintenance should continue until permanent erosion and sediment control measures are in place, established or stabilized to the satisfaction of the Engineer.

C. Fence Removal: The silt fence shall remain in place until the area is permanently stabilized as shown in the project plans and the Engineer directs that it be removed. The fence materials shall become the property of the Contractor and be removed from the site. The Contractor shall remove and dispose of any sediment accumulations and restore the area as directed by the Engineer.

3.7 POLLUTANTS

A. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near waterways and impoundments or into natural or manmade channels leading thereto.

3.8 WATER DISCHARGES

A. Water containing sediment from excavation, pump discharges or other operations shall be treated by filtration, settling basin or other means sufficient to prevent turbidity or sedimentation of receiving waterways. Turbid water or pump discharges shall not be allowed to enter waterways or impoundments.

3.9 MAINTENANCE

A. Ditches which are filled, and erosion and sedimentation control measures which have been displaced, or are partly or wholly inoperative, shall be cleaned and made operative before the Contractor stops work for each day, and shall be maintained in a condition satisfactory to the Engineer for the duration of the contract.

B. The Contractor shall ensure that all controls are functioning in an effective manner and address all failures or other problems in a pro-active manner, immediately. If a situation comes to the Engineer's attention, the Engineer will inform the Contractor of unsatisfactory construction procedures and operations insofar as water quality management are concerned. If the unsatisfactory construction procedures and operations are not corrected in a timely manner, the Engineer will suspend the performance of any or all operations until the unsatisfactory condition has been corrected.

END OF SECTION

ROCKLAND BOCES

STORMWATER POLLUTION PREVENTION PLAN (SWPPP) EROSION & SEDIMENT CONTROL ONLY

65 Parrott Road, West Nyack, NY 10994

TAX LOT SECTION 51.20, BLOCK 2, BLOCK 1,
TAX LOT SECTION 51.20, BLOCK 2, BLOCK 2,
TAX LOT SECTION 51.19, BLOCK 2, BLOCK 6,
ACRES 27.1 +/-
TOWN OF CLARKSTOWN, ROCKLAND COUNTY, NEW YORK

PREPARED BY:
FELLENZER ENGINEERING
22 MULBERRY STREET SUITE 2A
MIDDLETOWN, NEW YORK 10940
PROJECT 23-284

REPRESENTING:
Rockland BOCES
65 Parrott Road
West Nyack, NY 10994

June 17, 2025

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B. CONSTRUCTION SITE LOG BOOK
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   QUALIFIED PROFESSIONAL'S CERTIFICATION
   PRE-CONSTRUCTION SITE ASSESSMENT CHECKLIST
   CONSTRUCTION DURATION INSPECTIONS
   MONTHLY SUMMARY OF INSPECTION ACTIVITIES
C. NOI FORM (DRAFT)(NOT INCLUDED)

NARRATIVE

Rockland BOCES is proposing the development of a 2-story building comprised of office space, classrooms, kitchen and gym on the site located at 65 Parrott Road, West Nyack, NY 10994. Lot 51.20-2-1 & 6 and Lot 51.19-2-6 is approximately 27.1 acres, within the R-22 District (Medium Density Residential). No wetlands will be disturbed.

Total project disturbance will be less than one (1) acres; therefore, the New York State Department of Environmental Conservation requires that a Stormwater Pollution Prevention Plan (SWPPP) Erosion & Sediment Only Plan be completed.

EXISTING SITE –

Existing site features include multiple buildings with classrooms and other BOCES related activities. The site also has existing parking lots and roadways throughout the site. The site is bordered by a tree line on three sides and residential communities around the whole site.

PROPOSED WORK –

- 1 – Two Story Building (Office Space, Classrooms, Kitchen and Gym)
- Sidewalks and Loading area for kitchens
- Landscaping and Dumpster enclosure
- Site Lighting
- Electric transformer
- Emergency Generator
- Gas service
- Domestic Water service
- Fire service
- Sewer service

AREA OF DISTURBANCE/IMPERVIOUS CALCULATION

The total area of permanent disturbance is 0.99 acres, including grading, as follows:

- Building, 5 ft outside grading, food truck area, dumpster enclosure area, generator area, new walkways = 42,708.6 sq ft
- Crosswalk from west parking lot = 232.8 sq ft
- Transformer and pad = 147.1 sq ft
- Total = 43,089 sq ft / 43,560 sq ft/acre = 0.989 acres

The total impervious area is 0.89 acres, as follows:

- 43,089 sq ft – 4,310 sq ft grass = 38,779 sq ft / 43,560 sf/acre = 0.890 acres.

Soil remediation will be utilized in these areas per NYSDEC.

SOILS

The provided USDA Web Soil Survey Map (appendix A) shows that the underlying soils of the project area are:

- WeB (Wethersfield Gravelly Silt Loam)
- Ux (Urban Land)

Areas of cut and fill to be restored per the NYSDEC “Deep Ripping and De-compaction” Requirements, July, 2024.

SOIL RESTORATION

1. Soil Restoration as defined by "Deep Ripping and Compaction" (July 2024 NYSDEC) shall be performed in all areas to be re-graded (areas of cut/fill).

2. Soil restoration is not required in areas of minimal soil disturbance, such as clearing and grubbing, as per Table 5.3, NYSDEC Stormwater Design Manual, July 2024.
3. Regrading of site shall result in a balanced site, with equal cut/fill volumes.

EROSION AND SEDIMENT CONTROL

The erosion and sediment control practices and the design of erosion and sediment control plans were prepared in accordance with "New York State Standards and Specifications for Erosion and Sediment Control, 11/16 ed."

1. Planned Erosion and Sedimentation Control Practices

   a. Overall Objectives:

      (1) The overall objective of any erosion and sediment control plan is to control erosion to the maximum extent practicable at the source.

      (2) Existing vegetative cover shall be maintained to the maximum extent practicable and site disturbance shall be controlled to prevent soil disturbance beyond the "limits of disturbance" indicated on the site grading plans.

      (3) Where necessary, appropriate sediment control measures shall be installed at all existing project area drainage ways or stormwater management structures prior to the installation of erosion control measures within the project site.

      (4) All temporary erosion and sediment control measures shall be installed prior to any disturbance in any portion of the project site.

(5) All permanent erosion and sediment control measures shall be installed as early as possible or as directed by the site engineer. The only permanent measure proposed is permanent seeding.

(6) Unless specified elsewhere below, during construction activities at the project site, all erosion and sediment control measures shall be inspected and, if necessary, maintenance preformed, on a weekly basis.

b. Existing Stormwater Management Facilities:

(1) All existing stormwater management facilities, if present, shall be protected at all times. Maintenance of existing facilities is the responsibility of the owner of record.

c. Limits of Disturbance and Tree Preservation and Protection:

(1) Site disturbance shall be limited to the maximum extent practicable to “Limits of Disturbance” identified on the plans.

(2) Site conditions encountered during construction activities that point toward a need to disturb areas beyond the “Limits of Disturbance” shall be brought to the attention of the site engineer before undertaken. Engineer shall verify that the appropriate erosion & sediment control measures and BMPs are in place prior to start of work.

d. Filter Fabric Silt Fence or Silt Socks:

(1) Silt fences with woven wire backing for added support to prevent collapse are to be installed prior to the disturbance of any upslope areas, and around the entire perimeter of soil stockpiles at the end of the work day to prevent sediment from entering the drainage courses.

(2) A silt fence may be used subject to the following conditions:

a) Maximum allowable slope lengths contributing runoff to a silt fence placed on a slope are:

Slope Maximum	Steepness Length (ft.)
2:1	25
3:1	50
4:1	75
5:1 or flatter	100

b) Maximum drainage area for overland flow to a silt fence shall not exceed ¼ acre per 100 feet of fence, with maximum ponding depth of 1.5 feet behind the fence;

c) Erosion would occur in the form of sheet erosion;

d) There is no concentration of water flowing to the barrier.

(3) Inspection and maintenance shall be performed on a weekly basis and sediment material removed when “bulges” develop.

(4) Silt fences shall be removed when they are no longer needed or as directed by the site engineer.

e. Dust Control:

(1) At site access and other disturbed areas surface dust movement and dust blowing shall be controlled to the maximum extent practicable, and especially where off-site damage may occur or create a nuisance condition if dust is not controlled.

(2) Construction operations should be scheduled to minimize the amount of area disturbed at one time.

(3) Buffer areas of vegetation should be left where practical.

(4) Temporary or permanent stabilization measures shall be installed.

(5) Should excessive dust be generated, it should be controlled by sprinkling.

(6) Dust control measures shall continue through dry weather periods and/or until all disturbed areas are stabilized.

f. Stabilized Construction Entrance:

(1) A stabilized construction entrance(s) is/are to be completed prior to the start of construction activities.

(2) Installation Criteria:

a) Aggregate Size: Use a matrix of 1-4 inch stone, or reclaimed or recycled concrete equivalent.
b) Thickness: Not less than six (6) inches.
c) Width: 24-foot minimum
d) Length: Not less than 50 feet or as directed by the site engineer

e) Geotextile: To be placed over the entire area to be covered with aggregate. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

(3) The entrance shall be maintained in a condition which will prevent the tracking or flowing of sediment onto public rights-of-way or streets. This may require periodic top dressing with addition aggregate.

(4) All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately.

(5) When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way.

(6) When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment-trapping device.

(7) All sediment shall be prevented from entering storm drains, ditches, or watercourses.

(8) Inspection shall be performed weekly and needed maintenance shall be made promptly.

(9) The stabilized construction entrance shall be removed when it is no longer needed or as directed by the site engineer.

g. Diversion Swales:

(1) Temporary swales are to be constructed to:

a) To divert flows from entering a disturbed area.

b) Intermittently across disturbed areas to shorten overland flow distances.
c) To direct sediment laden water along the base of slopes to a trapping device.
d) To transport offsite flows across disturbed areas such as rights-of-way.

(2) Swales collecting runoff from disturbed areas shall remain in place until the disturbed areas are permanently stabilized.

(3) Where necessary, diversion swales are to be installed prior to the disturbance of areas.

(4) Stabilization of the swale shall be completed within 7 days of installation in accordance with the appropriate standard and specifications for vegetative stabilization or stabilization with mulch as determined by the time of year.

(5) The flow channel shall be stabilized as per the following criteria:

Channel Grade	Type of Treatment
0.5 - 5.0%	Seed and straw mulch
5.0 – 8.0%	Seed and cover with RECP, sod, or line with plastic or 2 in. stone
8.1 to 20%	Line with 4-8 in. stone or or geotextile

(6) Inspection and maintenance shall be performed on a weekly basis and repairs made promptly.

(7) Swales shall be filled in or graded when they are no longer needed or as directed by the site engineer.

h. Check Dams (none proposed)

i. Soil Stockpile Areas:

(1) Soil stockpile areas shall be established as soon as erodible material is excavated or collected.

(2) Soil stockpile areas shall be located where shown on the plans or as directed by the site engineer.

(3) Silt filter fencing shall be in place around the entire perimeter of the stockpile at the end of each workday.

(4) Depending on time of year stockpiles shall be stabilized by seeding or mulch as directed by the site engineer.

j. Stabilization of Disturbed Areas:

(1) Temporary stabilization of disturbed areas: depending on time of year shall include seeding and/or mulching applied to disturbed areas as soon as practicable or as directed by the site engineer.

(2) Temporary stabilization of disturbed areas: type of seed and the application rates for seeding and mulching shall be as specified on the plans.

(3) Temporary stabilization of disturbed areas: must be used on areas not under construction that will be exposed for more than 14 days.

(4) Permanent stabilization of disturbed areas: shall include seeding and munching, and may include soil augmentation and the application of fertilizer as directed by the site engineer.

(5) Permanent stabilization of disturbed areas: type of seed and the application rates for seeding and mulching shall be as specified on the plans, and soil augmentation and the application rate of fertilizer shall be as directed by the site engineer.

(6) Permanent stabilization of disturbed areas: shall be completed as soon as possible after construction activities in an area are completed.

(7) Permanent stabilization of disturbed areas with seed and mulch should be undertaken from March to May and September to October 15, and temporary stabilization can be utilized through November.

k. Permanent Erosion and Sediment Control Measures:

(1) Permanent erosion and sediment control measure to stabilize the project site (stabilization seeding) as indicated on the site development plans should be performed as soon as possible after completion of grading.

(2) All permanent erosion and sediment control measures designed and implemented must be properly maintained in order to remain functional.

1. **Construction Schedule**

   a. Obtain plan approval and other applicable permits.

   b. Hold pre-construction conference at least one week prior to starting construction, which is to be attended by the owner and the owner's contractor and site engineer.

   c. A mailbox or other means to store the SWPPP, drawings and Inspection Reports, shall be installed on site.

   d. At least 7 days before starting any earth disturbance activities, all contractors involved in those activities shall notify the New York One Call System Incorporated at 1-800-962-7962 for buried utilities locations.

   e. Construct stabilized construction entrance(s), as required.

   f. Sediment control measures shall be installed at all existing project area drainage ways or stormwater management structures prior to the installation of erosion control measure within the project site.

   g. Flag the limits of disturbance and vegetation to be preserved and protected.

   h. Install filter fabric silt fencing or silt soxx.

   i. Tree clearing and grubbing.

   j. Rough grade site, stockpile topsoil

   k. Soil remediation per NYSDEC

l. Finish grading as soon as rough grading is complete. Leave the surface slightly roughened and vegetate and mulch immediately.

m. Construction of proposed building.

n. Inspections per schedule.

o. Construction of utility services and lighting.

p. Pave access drives and parking areas..

q. Complete final grading

r. Complete final grading of grounds, topsoil critical areas, and permanently vegetate, landscape, and mulch.

s. After the site is stabilized, remove all temporary measures

t. Estimated time before final stabilization—3-4 months.

.NOTES:

1. The operator shall assure that the approved stormwater management plan is properly and completely implemented.

2. Construction vehicles and equipment may neither enter directly nor exit directly from the site without a construction entrance. Measures must be taken to prevent soil and sediment from a vehicle's tires from being deposited onto the public road.

3. Before initiating any revisions to the approved stormwater management plan or revisions to other plans that may affect the effectiveness of the approved

plan, the operator must receive approval of the revisions from the design engineer

5. The operator shall assure that the stormwater management plan has been prepared, approved by the design engineer, and is being implemented and maintained for all soil and/or rock spoil and borrow areas, regardless of their locations.

6. The stormwater management plan mapping must display a NY ONE CALL SYSTEM INCORPORATED symbol including the site identification number. (This is a numbered symbol not a note.)

7. Immediately after earth disturbance activities cease, within 14 days, the operator shall stabilize any areas disturbed by the activities. During non-germinating periods, mulch must be applied at the specified rates. Disturbed areas which are not at finished grade and which will be redistributed within 1 year must be stabilized in accordance with the temporary vegetative stabilization specifications. Disturbed areas which are at finished grade or which will not be redistributed within 1 year must be stabilized in accordance with the permanent vegetative stabilization specifications.

8. The operator shall remove from the site, recycle, or dispose of all building materials and wastes in accordance with all applicable state and local codes. The contractor shall not illegally bury, dump, or discharge any building material or wastes at the site.

APPENDIX A

WEB SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Rockland County, New York



October 21, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:782 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Rockland County, New York
Survey Area Data: Version 22, Aug 25, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 21, 2022—Oct 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ux	Urban land	0.7	31.6%
WeB	Wethersfield gravelly silt loam, 3 to 8 percent slopes	1.5	68.4%
Totals for Area of Interest		**2.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Rockland County, New York

Ux—Urban land

Map Unit Setting

National map unit symbol: 9v5g
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Holyoke

Percent of map unit: 5 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents

Percent of map unit: 5 percent
Hydric soil rating: No

Yalesville

Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

WeB—Wethersfield gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9v5l

Elevation: 30 to 690 feet
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wethersfield and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wethersfield

Setting

Landform: Hills, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy acid till derived mainly from reddish sandstone, shale, and conglomerate, with some basalt

Typical profile

H1 - 0 to 13 inches: gravelly silt loam
H2 - 13 to 22 inches: gravelly loam
H3 - 22 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 38 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F145XY012CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 5 percent
Hydric soil rating: No

Cheshire

Percent of map unit: 5 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Wallington

Percent of map unit: 5 percent
Hydric soil rating: No

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APPENDIX B

CONSTRUCTION SITE LOG BOOK

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM FOR CONSTRUCTION ACTIVITIES

CONSTRUCTION SITE LOG BOOK

Table of Contents

I. Pre-Construction Meeting Documents
- a. Preamble to Site Assessment and Inspections
- b. Operator's Certification
- c. Qualified Professional's Credentials & Certification
- d. Pre-Construction Site Assessment Checklist

II. Construction Duration Inspections
- a. Directions
- b. Modification to the SWPPP

III. Monthly Summary Reports

IV. Monitoring, Reporting, and Three-Month Status Reports
- a. Operator's Compliance Response Form

Properly completing forms such as those contained in this Appendix the inspection requirement of NYSDEC SPDES GP for Construction Activities. Completed forms shall be kept on site at all times and made available to authorities upon request.

I. PRE-CONSTRUCTION MEETING DOCUMENTS

Project Name

_____

Permit No. _____ Date of Authorization

_____

Name of Operator

_____

Prime Contractor

_____

a. Preamble to Site Assessment and Inspections

The Following Information To Be Read By All Person's Involved in The Construction of Stormwater Related Activities:

The Operator agrees to have a qualified professional[1] conduct an assessment of the site prior to the commencement of construction[2] and certify in this inspection report that the appropriate erosion and sediment controls described in the SWPPP have been adequately installed or implemented to ensure overall preparedness of the site for the commencement of construction.

Prior to the commencement of construction, the Operator shall certify in this site logbook that the SWPPP has been prepared in accordance with the State's standards and meets all Federal, State and local erosion and sediment control requirements.

When construction starts, site inspections shall be conducted by the qualified professional at least every 7 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater (Construction Duration Inspections). The Operator shall maintain a record of all inspection reports in this site logbook. The site logbook shall be maintained on site and be made available to the permitting authorities upon request. The Operator shall post at the site, in a publicly accessible location, a summary of the site inspection activities on a monthly basis (Monthly Summary Report).

The operator shall also prepare a written summary of compliance with this general permit at a minimum frequency of every three months (Operator's Compliance Response Form), while coverage exists. The summary should address the status of achieving each component of the SWPPP.

Prior to filing the Notice of Termination or the end of permit term, the Operator shall have a qualified professional perform a final site inspection. The qualified professional shall certify that the site has undergone final stabilization[3] using either vegetative or structural stabilization methods and that all temporary erosion and sediment controls (such as silt fencing) not needed for long-term erosion control have been removed. In addition, the Operator must identify and certify that all permanent structures described in the SWPPP have been constructed and provide the owner(s) with an operation and maintenance plan that ensures the structure(s) continuously functions as designed.

1 "Qualified Professional means a person knowledgeable in the principles and practice of erosion and sediment controls, such as a Certified Professional in Erosion and Sediment Control (CPESC), soil scientist, licensed engineer or someone working under the direction and supervision of a licensed engineer (person must have experience in the principles and practices of erosion and sediment control).

2 "Commencement of construction" means the initial removal of vegetation and disturbance of soils associated with clearing, grading or excavating activities or other construction activities.

3 "Final stabilization" means that all soil-disturbing activities at the site have been completed and a uniform, perennial vegetative cover with a density of eighty (80) percent has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed on all unpaved areas and areas not covered by permanent structures.

b. Operators Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. Further, I hereby certify that the SWPPP meets all Federal, State, and local erosion and sediment control requirements. I am aware that false statements made herein are punishable as a class A misdemeanor pursuant to Section 210.45 of the Penal Law.

Name (please print):

_____

Title _____ Date: _____

Address:

_____

Phone: _____ Email: _____

Signature:

_____

c. Qualified Professional's Credentials & Certification

“I hereby certify that I meet the criteria set forth in the General Permit to conduct site inspections for this project and that the appropriate erosion and sediment controls described in the SWPPP and as described in the following Pre-construction Site Assessment Checklist have been adequately installed or implemented, ensuring the overall preparedness of this site for the commencement of construction.”

Name (please print):

_____

Title _____ Date: _____

Address:

_____

Phone: _____ Email: _____

Signature:

_____

d. Pre-construction Site Assessment Checklist
(NOTE: Provide comments below as necessary)

1. Notice of Intent, SWPPP, and Contractors Certification:

Yes No NA

[ ] [ ] [ ] Has a Notice of Intent been filed with the NYS Department of Conservation?
[ ] [ ] [ ] Is the SWPPP on-site? Where?_____
[ ] [ ] [ ] Is the Plan current? What is the latest revision date? _____
[ ] [ ] [ ] Is a copy of the NOI (with brief description) onsite? Where? _____
[ ] [ ] [ ] Have all contractors involved with stormwater related activities signed a contractor's certification?

2. Resource Protection

Yes No NA

[ ] [ ] [ ] Are construction limits clearly flagged or fenced?
[ ] [ ] [ ] Important trees and associated rooting zones, on-site septic system absorption fields, existing vegetated areas suitable for filter strips, especially in perimeter areas, have been flagged for protection.
[ ] [ ] [ ] Creek crossings installed prior to land-disturbing activity, including clearing and blasting.

3. Surface Water Protection

Yes No NA

[ ] [ ] [ ] Clean stormwater runoff has been diverted from areas to be disturbed.
[ ] [ ] [ ] Bodies of water located either on site or in the vicinity of the site have been identified and protected.
[ ] [ ] [ ] Appropriate practices to protect on-site or downstream surface water are installed.
[ ] [ ] [ ] Are clearing and grading operations divided into areas <5 acres?

4. Stabilized Construction Entrance

Yes No NA

[ ] [ ] [ ] A temporary construction entrance to capture mud and debris from construction vehicles before they enter the public highway has been installed.
[ ] [ ] [ ] Other access areas (entrances, construction routes, equipment parking areas) are stabilized immediately as work takes place with gravel or other cover.
[ ] [ ] [ ] Sediment tracked onto public streets is removed or cleaned on a regular basis.

5. Perimeter Sediment Controls

Yes No NA

[ ] [ ] [ ] Silt fence material and installation comply with the standard drawing and specifications.
[ ] [ ] [ ] Silt fences are installed at appropriate spacing intervals
[ ] [ ] [ ] Sediment/detention basin was installed as first land disturbing activity.
[ ] [ ] [ ] Sediment traps and barriers are installed.

6. Pollution Prevention for Waste and Hazardous Materials

Yes No NA

[ ] [ ] [ ] The Operator or designated representative has been assigned to implement the spill prevention avoidance and response plan.
[ ] [ ] [ ] The plan is contained in the SWPPP on page _____
[ ] [ ] [ ] Appropriate materials to control spills are onsite. Where? _____

CONSTRUCTION DURATION INSPECTIONS

a. Directions: Inspection Forms will be filled out during the entire construction phase of the project.

Required Elements:

(1) On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period;

(2) Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization;

(3) Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period;

(4) Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of sediment storage volume (for example, 10 percent, 20 percent, 50 percent);

(5) Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (earthen berms or silt fencing) and containment systems (sediment basins and sediment traps). Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water; and

(6) Immediately report to the Operator any deficiencies that are identified with the implementation of the SWPPP.

CONSTRUCTION DURATION INSPECTIONS Page 1 of _____

SITE PLAN/SKETCH

Inspector (print name)	**Date of Inspection**
Qualified Professional (print name)	**Qualified Professional Signature**

The above signed acknowledges that, to the best of his/her knowledge, all information provided on the forms is accurate and complete.

CONSTRUCTION DURATION INSPECTIONS Page 2 of _____

Maintaining Water Quality
Yes No NA
[ ] [ ] [ ] Is there an increase in turbidity causing a substantial visible contrast to natural conditions?
[ ] [ ] [ ] Is there residue from oil and floating substances, visible oil film, or globules or grease?
[ ] [ ] [ ] All disturbance is within the limits of the approved plans.
[ ] [ ] [ ] Have receiving lake/bay, stream, and/or wetland been impacted by silt from project?

Housekeeping
1. General Site Conditions
Yes No NA
[ ] [ ] [ ] Is construction site litter and debris appropriately managed?
[ ] [ ] [ ] Are facilities and equipment necessary for implementation of erosion and sediment control in working order and/or properly maintained?
[ ] [ ] [ ] Is construction impacting the adjacent property?
[ ] [ ] [ ] Is dust adequately controlled?

2. Temporary Stream Crossing
Yes No NA
[ ] [ ] [ ] Maximum diameter pipes necessary to span creek without dredging are installed.
[ ] [ ] [ ] Installed non-woven geotextile fabric beneath approaches.
[ ] [ ] [ ] Is fill composed of aggregate (no earth or soil)?
[ ] [ ] [ ] Rock on approaches is clean enough to remove mud from vehicles & prevent sediment from
entering stream during high flow.

Runoff Control Practices
1. Excavation Dewatering
Yes No NA
[ ] [ ] [ ] Upstream and downstream berms (sandbags, inflatable dams, etc.) are installed per plan.
[ ] [ ] [ ] Clean water from upstream pool is being pumped to the downstream pool.
[ ] [ ] [ ] Sediment laden water from work area is being discharged to a silt-trapping device.
[ ] [ ] [ ] Constructed upstream berm with one-foot minimum freeboard.

2. Level Spreader
Yes No NA
[ ] [ ] [ ] Installed per plan.
[ ] [ ] [ ] Constructed on undisturbed soil, not on fill, receiving only clear, non-sediment laden flow.
[ ] [ ] [ ] Flow sheets out of level spreader without erosion on downstream edge.

3. Interceptor Dikes and Swales
Yes No NA
[ ] [ ] [ ] Installed per plan with minimum side slopes 2H:1V or flatter.
[ ] [ ] [ ] Stabilized by geotextile fabric, seed, or mulch with no erosion occurring.
[ ] [ ] [ ] Sediment-laden runoff directed to sediment trapping structure

CONSTRUCTION DURATION INSPECTIONS Page 3 of _____

Runoff Control Practices (continued)

4. Stone Check Dam
Yes No NA
[ ] [ ] [ ] Is channel stable? (flow is not eroding soil underneath or around the structure).
[ ] [ ] [ ] Check is in good condition (rocks in place and no permanent pools behind the structure).
[ ] [ ] [ ] Has accumulated sediment been removed?.

5. Rock Outlet Protection
Yes No NA
[ ] [ ] [ ] Installed per plan.
[ ] [ ] [ ] Installed concurrently with pipe installation.

Soil Stabilization

1. Topsoil and Spoil Stockpiles
Yes No NA
[ ] [ ] [ ] Stockpiles are stabilized with vegetation and/or mulch.
[ ] [ ] [ ] Sediment control is installed at the toe of the slope.
2. Revegetation
Yes No NA
[ ] [ ] [ ] Temporary seedings and mulch have been applied to idle areas.
[ ] [ ] [ ] 4 inches minimum of topsoil has been applied under permanent seedings

Sediment Control Practices

1. Stabilized Construction Entrance
Yes No NA
[ ] [ ] [ ] Stone is clean enough to effectively remove mud from vehicles.
[ ] [ ] [ ] Installed per standards and specifications?
[ ] [ ] [ ] Does all traffic use the stabilized entrance to enter and leave site?
[ ] [ ] [ ] Is adequate drainage provided to prevent ponding at entrance?
2. Silt Fence
Yes No NA
[ ] [ ] [ ] Installed on Contour, 10 feet from toe of slope (not across conveyance channels).
[ ] [ ] [ ] Joints constructed by wrapping the two ends together for continuous support.
[ ] [ ] [ ] Fabric buried 6 inches minimum.
[ ] [ ] [ ] Posts are stable, fabric is tight and without rips or frayed areas.
Sediment accumulation is ___% of design capacity.

CONSTRUCTION DURATION INSPECTIONS Page 4 of _____
Sediment Control Practices (continued)

3. Storm Drain Inlet Protection (Use for Stone & Block; Filter Fabric; Curb; or, Excavated practices)
Yes No NA
[ ] [ ] [ ] Installed concrete blocks lengthwise so open ends face outward, not upward.
[ ] [ ] [ ] Placed wire screen between No. 3 crushed stone and concrete blocks.
[ ] [ ] [ ] Drainage area is 1acre or less.
[ ] [ ] [ ] Excavated area is 900 cubic feet.
[ ] [ ] [ ] Excavated side slopes should be 2:1.
[ ] [ ] [ ] 2" x 4" frame is constructed and structurally sound.
[ ] [ ] [ ] Posts 3-foot maximum spacing between posts.
[ ] [ ] [ ] Fabric is embedded 1 to 1.5 feet below ground and secured to frame/posts with staples at max 8-
inch spacing.
[ ] [ ] [ ] Posts are stable, fabric is tight and without rips or frayed areas.
Sediment accumulation ___% of design capacity.

4. Temporary Sediment Trap
Yes No NA
[ ] [ ] [ ] Outlet structure is constructed per the approved plan or drawing.
[ ] [ ] [ ] Geotextile fabric has been placed beneath rock fill.
Sediment accumulation is ___% of design capacity.

5. Temporary Sediment Basin
Yes No NA
[ ] [ ] [ ] Basin and outlet structure constructed per the approved plan.
[ ] [ ] [ ] Basin side slopes are stabilized with seed/mulch.
[ ] [ ] [ ] Drainage structure flushed and basin surface restored upon removal of sediment basin facility.

Sediment accumulation is ___% of design capacity.

Note: Not all erosion and sediment control practices are included in this listing. Add additional pages
to this list as required by site specific design.

Construction inspection checklists for post-development stormwater management practices can be found in Appendix F of the New York Stormwater Management Design Manual.

CONSTRUCTION DURATION INSPECTIONS Page 5 of ___

b. Modifications to the SWPPP (To be completed as described below)

The Operator shall amend the SWPPP whenever:

1. There is a significant change in design, construction, operation, or maintenance which may have a significant effect on the potential for the discharge of pollutants to the waters of the United States and which has not otherwise been addressed in the SWPPP; or
2. The SWPPP proves to be ineffective in:
   a. Eliminating or significantly minimizing pollutants from sources identified in the SWPPP and as required by this permit; or
   b. Achieving the general objectives of controlling pollutants in stormwater discharges from permitted construction activity; and
3. Additionally, the SWPPP shall be amended to identify any new contractor or subcontractor that will implement any measure of the SWPPP.

Modification & Reason:

III. Monthly Summary of Site Inspection Activities

Name of Permitted Facility:	**Today's Date:**	**Reporting Month:**
Location:		**Permit Identification #:**
Name and Telephone Number of Site Inspector:		

Date of Inspection	Regular / Rainfall based Inspection	Name of Inspector	Items of Concern

Owner/Operator Certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein are punishable as a class A misdemeanor pursuant to Section 210.45 of the Penal Law."

_____

_____

Signature of Permittee or Duly Authorized Representative Name of Permittee or Duly Authorized Representative Date

Duly authorized representatives must have written authorization, submitted to DEC, to sign any permit documents.

APPENDIX C

NOTICE OF INTENT (NOI) FORM

(NOT INCLUDED)

SECTION 01 60 00 – PRODUCT REQUIREMENTS

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 the Contractor's selection of products for use in the Project.
   1. Single Prime Contract: Provisions of this Section apply to the construction activities of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Electronic Submittal Procedures" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
   2. Division 1 Section "Substitution Procedures" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
   1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
      a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
   2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
   3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. Each prime contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate contractors.
   2. If a dispute arises between prime contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
   1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
   5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
   6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
   7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
   1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
   1. Nonproprietary Specifications: When 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.
   2. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
   3. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
   4. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
   5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
   6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
   7. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
   8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.
   9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
   1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 60 00

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SECTION 01 7329
CUTTING AND PATCHING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.02 DEFINITIONS

A. Cutting: Removal of in-place 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.

1.03 SUBMITTALS

A. Cutting and Patching:
   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Products: List products to be used
   3. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   4. Approval: Obtain approval of cutting and patching before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.04 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. 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. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Fire-suppression systems.
   4. Mechanical systems piping and ducts.
   5. Control systems.
   6. Communication systems.
   7. Conveying systems.
   8. Electrical wiring systems.
   9. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   1. Water, moisture, or vapor barriers.
   2. Membranes and flashings.
   3. Exterior curtain-wall construction.
   4. Equipment supports.
   5. Piping, ductwork, vessels, and equipment.
   6. Noise and vibration-control elements and systems.

D. 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.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.05 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.01 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 in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.03 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 in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or

adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. 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 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

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.
   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.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      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. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 7329

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SECTION 01 74 23 - CLEANING UP – SINGLE PRIME

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.

PRODUCTS

Materials: Use only cleaning materials recommended by manufacturer of surface to be cleaned.

PART 2 - EXECUTION

2.1 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. **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.

2.2 FINAL CLEANING

A. 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. **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, flooring, ceramic tile, doors, windows, 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.

C. **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

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

2.3 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 017700 – 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 instructions of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements. Startup 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 complete 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 complete 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 inspection 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.

END OF SECTION 017700

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SECTION 017701 – CHECKLIST FOR PROJECT CLOSEOUT AND PROCESSING OF FINAL PAYMENT

PART 1 - GENERAL

1.1. FINAL PAYMENT

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 – electrical, elevator, etc.).
[ ] Spare parts and Maintenance Materials (receipt signed by ACCI & Owner).
[ ] 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 two-year warranty and extended warranties (if any required).
[ ] Two-year maintenance bond.
[ ] 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 017701

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SECTION 017719 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1. SUMMARY

A. Requirements set forth herein are in addition to and shall be considered as complementary to the General Conditions of the Contract and project specifications.
B. All Contractors, Subcontractors, Sub-Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2. REQUIREMENTS

A. Project Record Drawings
B. Record Drawing Certification

1.3. PROJECT RECORD DRAWINGS

A. The purpose of the project drawings is to record the actual location of the work in place including but not limited to underground lines, concealed piping within buildings, concealed valves and control equipment, and to record changes in the work.
B. In addition to the above, these drawings shall be “color-coded”, by each trade, on a daily basis to indicate progress of the work. Color legend will be assigned by the Architect.
C. In addition to the sets of contract drawings that are required by the Contractor on the site to perform the work, the Contractor shall maintain, at the site, one (1) copy of all drawings, specifications and addenda that are part of the Contract as awarded.
D. Each of these documents should be clearly marked “Project Record Copy”, maintained in a clean and neat condition available at all times for inspections by the Owner, Construction Manager or the Architect, and shall not be used for any other purpose during the progress of the work.
E. The Construction Manager will be the custodian on the project record documents until the end of the Project.
F. Project Record Requirements
  1. The Contractor shall mark-up the “Project Record Copy” to show:
    a. Approved changes in the work.
    b. Location of underground work and completed work.
    c. Details not shown in the original Contract Documents.
    d. Any relocation of work including piping, conduits, ducts and the like.
    e. All changes in dimensions.
    f. All access doors and “tack” location access points in accessible ceilings.
    g. Location of all plumbing, heating, ventilating, air conditioning or electrical assemblies, whether existing to remain or newly installed.
    h. Revisions to any electrical circuitry.

2. Such information shall include, but shall not be limited to:
   a. Footing depth in relation to finished grade elevations.
   b. Any change in floor elevations.
   c. Any structural changes.
   d. Any substitutions
   e. Elevations and locations of all underground utilities, services, or structures referenced to permanent above ground structures and monuments.
   f. Designation of all utilities as to the size and use of such utilities.
   g. All invert elevations of manholes.
   h. The location of all utilities, services and appurtenances concealed in building structures that have been installed differently from that required by the Contract.
   i. Any approved change order.
   j. Other such data as required by the Architect and/or Owner so as to establish a complete record of “As-Constructed” conditions.

G. The Contractor shall keep the project record documents up-to-date from day to day as the work progresses. Appropriate documents are to be updated promptly and accurately; no work is to be permanently concealed until all required information has been recorded.

H. The project record drawings are to be submitted by the Contractor to the Architect through the Construction Manager when all the work is completed and is approved by the Owner and the Architect before the Contractor may request final payment.

I. If the project record drawings as submitted are found to be unacceptable due to incompleteness or inaccurate information, the drawings shall be returned to the offending Contractor for corrective action and resubmitted for approval prior to the release of final payment.

FINAL PAYMENT IS CONTINGENT UPON DELIVERY OF FINAL PROJECT RECORD DRAWINGS TO THE OWNER AND ARCHITECT ON A SET OF FULL-SIZE PLTS AND ELECTRONIC FILES IN .DQG AND .PDF FORMATS.

J. In addition to the drawings required as mentioned above, the Contractor shall submit a list of all approved Shop Drawings of the Work as installed.

K. From this list the Architect will select the drawings desired for the permanent records. The Contractor shall furnish these in a bound set to the Owner as part of the closeout requirements.

1.4. RECORD DRAWING CERTIFICATION

A. The record drawings required under the terms and conditions of this Section shall be reviewed and processed by each of the Prime Contractors as part of their overall contractual responsibility.

B. This certification may be issued for individual trades as a collective document to cover the entire record drawing requirements of the project.

The format of this certification shall be as follows:

The record drawings prepared by:

_____

for _____ have been reviewed by the undersigned and:

Appears to be an accurate representation of the work incorporated within the project and are accepted as submitted in accordance with the technical documents.

This record document review made by this office is for determination of compliance to the requirements of the Contract Documents.

Firm Name: _____

Review Date: _____ By: _____

END OF SECTION 017719

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SECTION 017823 – OPERATION AND MAINTENANCE REQUIREMENTS

PART 1 - GENERAL

1.1. SUMMARY

A. Requirements set forth herein are in addition to and shall be considered as complementary to the General Conditions of the Contract and the project specifications.
B. All Contractors, Subcontractors, Sub-Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2. REQUIREMENTS

A. Startup and Demonstration
B. Parts List
C. Operation and Maintenance Data

1.3. STARTUP AND DEMONSTRATION

A. The work required herein consists of starting up and demonstrating all systems and equipment to operating personnel and includes training of said operating personnel.
B. The respective Trade or Subcontractor shall make arrangements, via the Construction Manager and/or the Owner (with notification to the Architect), as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the period of time in which they are to be given.
C. As specified in individual sections, furnish the services of instructors to train designated personnel in adjustment, operation, maintenance, and safety requirements of equipment and systems. If procedures are not specified for specific items of equipment, follow that recommended by the item manufacturer.
D. Instructors shall be thoroughly familiar with the equipment and systems and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given after the equipment or system has been accepted and turned over to the Owner. The duration of instruction shall be as specified in individual sections but shall be not less than two (2) days of each portion of operating mechanical/electrical systems. Use Operating and Maintenance Data as a training guide.
E. The Architect shall be completely satisfied that the representative of the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Contractor to the Owner’s Representative, then the offending Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the Specification has been complied with as determined by the Architect.

1.4. PARTS LIST

A. As required the respective Trade or Subcontractor shall furnish three (3) typed sets of instructions for the ordering and stocking of spare parts for all equipment installed. The lists shall include parts numbered and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

1.5. OPERATION AND MAINTENANCE DATA

A. The Contractor shall submit to the Architect for approval three (3) typed sets, bound neatly in hard backed loose-leaf binders, of all instructions for the installation, operation, care and maintenance of all equipment, fixtures and systems.
- **1.** Provide typed or printed label identifying binder as operating and maintenance data. List title of project, contract number, and location of equipment.
- **2.** Furnish manufacturer's printed data or sheets neatly typewritten on 8-1/2 inch by 11 inch, 20 pound minimum white paper. Provide indexed tabs.
- **3.** Drawings: Bind in with text. Provide reinforcement rings. Fold larger drawings to the size of the text pages.
- **4.** Information shall indicate possible problems with equipment and suggested corrective action.

1.6. CONTENT OF MANUAL FOR EQUIPMENT AND SYSTEMS

A. The instructions shall contain information deemed necessary by the Architect and include but not be limited to the following:
- **1.** Introduction:
  - **a.** Explanation of Manual and its use.
  - **b.** Summary description of all mechanical and electrical and equipment operating systems.
  - **c.** Purpose of systems.
  - **d.** Maintenance scheduling summary analysis, sheets and software operating instructions and diskette(s).
- **2.** System:
  - **a.** Detailed description of all systems.
  - **b.** Illustrations, schematics, block diagrams, photographs and other exhibits.
  - **c.** Complete wiring diagrams, tabulations and installation drawings.
  - **d.** Valve tag charts and control diagrams.
  - **e.** ½ size reduced copy of "Record Drawings"
- **3.** Operations:
  - **a.** Complete detailed, step-by-step, sequential description of all phases of operation for portion of the systems, including startup, shutdown, adjusting and balancing, and emergency procedures. Include all posted instruction charts.

4. Maintenance:
   a. Parts list and parts number.
   b. Maintenance, lubrication and replacement charts and Contractor's recommendations for preventative maintenance.
   c. Troubleshooting charts for systems and components.
   d. Instructions of testing each type of part.
   e. Recommended list of on-hand spare parts.
   f. Complete calibration instructions for all parts and entire systems.
   g. Instructions for charging, filling, draining and purging.
   h. General or miscellaneous maintenance notes.
5. Manufacturer's Literature:
   a. Complete listing for all parts with names, addresses and telephone numbers.
   b. Care and operation.
   c. All and other pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
   d. Internal wiring diagrams and engineering data sheets for all items and/or equipment to be furnished.
   e. Guarantee and warranty data.
6. Instruction for lubricating each piece of equipment installed. Instructions shall state type of lubricant, where and how frequently lubrication is required.
7. Frame all instructions under glass and hang in the Mechanical Room or other location as directed by Architect.

1.7. MANUALS FOR PRODUCTS, MATERIALS, AND FINISHES

A. Submit three (3) copies of complete manual.
B. Content: Provide complete information for Architectural products, applied materials, and finishes.
   1. Manufacturer's data, including catalog number, size, composition, color and texture designations, and information for reordering.
   2. Instructions for care and maintenance, including manufacturer's recommendations for cleaning agents and methods; cautions detrimental cleaning agents and methods; and recommended schedule for cleaning and maintenance.

END OF SECTION 017823

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SECTION 01 78 36 - WARRANTIES

PART 1 - GENERAL

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 "Execution and closeout requirements" specifies contract closeout procedures.
   3. Divisions 2 through 16 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: General 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 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 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, for approval prior to final execution.
   1. Refer to Divisions 2 through 16 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. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind warranties and bonds 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.
   3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION 01 78 36

Tectonic

PRACTICAL SOLUTIONS. EXCEPTIONAL SERVICE.

GEOTECHNICAL EVALUATION
ROCKLAND BOCES
NEW P-TECH C-TECH BUILDING
65 PARROTT ROAD
WEST NYACK, ROCKLAND COUNTY, NEW YORK

Submitted To:

KSQ Design

215 W 40th Street
15th Floor
New York, NY 10018

September 13, 2024

W.O. 12651.01

Submitted By:

Tectonic Engineering Consultants, Geologists & Land Surveyors, D.P.C.

1279 Route 300, 2nd Floor
Newburgh, NY 12550

(P) 845.567.6656
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KSQ Design
215 W 40th Street
15th Floor
New York, NY 10018

Attention: Ms. Ofe Pearson, AIA - Associate Principal
VIA E-MAIL (opearson@ksq.design)

September 13, 2024

RE: W.O. 12651.01
GEOTECHNICAL EVALUATION
ROCKLAND BOCES
NEW P-TECH C-TECH BUILDING
65 PARROTT ROAD
WEST NYACK, ROCKLAND COUNTY, NEW YORK

Dear Ms. Pearson:

Tectonic Engineering Consultants, Geologists & Land Surveyors, D.P.C. is pleased to submit this subsurface investigation and geotechnical engineering evaluation for the proposed new P-TECH C-TECH building to be located on the Rockland BOCES campus at 65 Parrott Road, Rockland County, West Nyack, New York. The purpose of the investigation was to characterize the subsurface conditions at the proposed building site and to develop recommendations for the geotechnical aspects of building design and construction. This report presents our findings and recommendations.

We appreciate this opportunity to assist you with this project. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

TECTONIC ENGINEERING CONSULTANTS, GEOLOGISTS & LAND SURVEYORS, D.P.C.

STATE OF NEW YORK
CHRISTOPHER BURKE
LICENSED
078832
PROFESSIONAL ENGINEER

Christopher Burke, Ph.D., P.E., PMP
Vice President, Geotechnical

"\\Tectonic\TecData\Newburgh\Geotechnical\12600\12651.01 Rockland BOCES PTECH Building\Report\TEC Cover Letter.docx"

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GEOTECHNICAL EVALUATION
ROCKLAND BOCES
NEW P-TECH C-TECH BUILDING
65 PARROTT ROAD
WEST NYACK, ROCKLAND COUNTY, NEW YORK

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1.0 INTRODUCTION

In accordance with your request and authorization, Tectonic Engineering Consultants, Geologists & Land Surveyors D.P.C. (Tectonic) has completed a subsurface investigation and geotechnical engineering evaluation for the proposed new P-TECH C-TECH building to be located on the Rockland BOCES campus at 65 Parrott Road, Rockland County, West Nyack, New York. The purpose of the investigation was to characterize the subsurface conditions at the proposed building site and to develop recommendations for the geotechnical aspects of building design and construction. This report presents our findings and recommendations.

2.0 SCOPE OF SERVICES

The following services were performed for KSQ Design, herein referred to as Client:

- Performance of a ground penetrating radar (GPR) survey at proposed boring locations in an effort to avoid buried utilities.
- Review of publicly available geologic, topographic, and other information through the United States Geological Survey (USGS) and other local, state, or national agencies.
- Drilling, sampling, and logging of seven (7) test borings to depths ranging from about 8.5 to 21 feet below existing grade.
- Installation of one (1) groundwater observation well within a select boring.
- Field inspection by a Tectonic representative, working under the purview of a New York State licensed Professional Engineer, which included locating the borings and rock probes; collecting soil and bedrock samples from the borings; logging and classifying soil and bedrock samples; observation of well installations, and subsequent recording of groundwater levels within wells.
- Laboratory testing of select soil samples to assist in evaluating their engineering characteristics and verify the field classifications.
- Geotechnical engineering evaluation of the subsurface conditions and laboratory test results as they relate to the design and construction of the proposed building.
- Preparation of this geotechnical report presenting the results of the investigation, laboratory testing, engineering analyses, and recommendations for the geotechnical aspects of building design and construction.

3.0 SITE AND PROJECT DESCRIPTIONS

The project site is located on the Rockland BOCES campus at 65 Parrott Road in the Hamlet of West Nyack, Rockland County, New York. The site consists of an existing grass lawn area located immediately west of the BOCES Career & Technology Education Center, an existing 2-story brick building with appurtenant facilities

including sidewalks, lighting structures, and a parking lot. The site is bound in part by Parrott Road to the north, the BOCES Career & Tech. Ed. Center and additional grass lawn area to the east, and asphalt paved driveways to the south and west.

A review of the Client provided drawings entitled "Rockland BOCES P-TECH C-TECH Building", Sheet C-101, dated May 17, 2024, indicates site topography generally slopes gradually towards the west-northwest. Surface grades within the site range from a high elevation of approximately +205 feet along the eastern site boundary to a low elevation of approximately +201 feet at the western-northwestern edge of the site. All elevations referenced within this report are relative to the North American Vertical Datum of 1988 (NAVD88). Additionally, from email conversations with KSQ Design and GACE Consulting Engineers, and review of preliminary structural drawings entitled "Rockland BOCES P-Tech C-Tech Building", Sheets S-001 to S-301, dated August 27, 2024, the building will not include a basement, but will include an elevator pit extending approximately 5 feet below top of slab elevation. Additionally, preliminary structural design includes the use of rock anchors as tension tie-downs within the foundation system.

The nearest adjacent building to the site is the 2-story BOCES Career & Technology Education Center, located adjacent to the northeast edge of the site. This building is currently in use as an educational and classroom facility. The Client provided survey, referenced above, indicates this existing building has a finished floor elevation of +205 feet. General observation of a portion of the building's exterior at the time of the investigation indicated the structure was in relatively good condition. Additionally, three (3) 1-story brick structures are located adjacent to the south end of the site, separated from the proposed P-Tech C-Tech structure by an asphalt paved roadway. Similarly, from limited exterior observation at the time of the investigation, these buildings were observed to be in use and in relatively good condition.

Based on review of the project RFP, client provided drawings, and subsequent conversations with the project Architect (KSQ Design) and Structural Engineer (GACE Consulting Engineers), we understand that the proposed building will be a 2-story structure having an approximate footprint of 32,000 square feet (sf) and a proposed finished floor elevation of +204 feet. The proposed structure will contain classrooms, a cafeteria, and gym. An elevator pit is proposed at the approximate southwest corner of the building footprint and will extend approximately 5 feet below finished floor elevation. No other sub-finished floor elevation pits or basement areas are proposed for this structure.

4.0 SUBSURFACE INVESTIGATION

The subsurface investigation consisted of the drilling, sampling, and logging of seven (7) test borings designated B-1 through B-7. The borings were performed throughout the footprint of the proposed building. The borings were advanced to depths of between 8.5 and 21 feet below existing ground surface (bgs).

Prior to drilling, a Ground Penetrating Radar (GPR) survey was performed by a representative of SoftDig Underground Services, Inc., between July 8 and July 10, 2024 to locate and mark existing utilities throughout the site. Results of this survey are included as Appendix II.

The borings were performed by Core Down Drilling, Inc., on August 6 through August 8, 2024 using a CME 55 Track Mounted drill rig with an automatic hammer and advanced using a 3-¼" I.D. hollow-stem auger. Rock coring was performed using an NX double-tube diamond core barrel. Standard Penetration Testing (SPT) and split-spoon sampling was performed within the borings in general accordance with the requirement of ASTM Standard D1586 *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Field SPT N-values were recorded for each soil sample taken, and samples of the soil obtained during the investigation were collected, retained, and are currently stored at our material testing laboratory. Upon completion, the boreholes were backfilled with drill cuttings to match the existing conditions.

A groundwater observation well, designated OW-1, was installed within Boring B-4. The well was constructed with a 10-foot length of 2-inch nominal slotted PVC well screen placed to the top of competent bedrock, and then solid PVC to grade. Well sand was placed within the annular space around the well screen to a height of 2 feet above the well screen. The remainder of the annular space between the PVC risers and borehole walls were backfilled with drill cuttings, and a manhole type well cover was placed at the top of the wells.

A Tectonic representative observed the subsurface investigation and prepared logs of the subsurface conditions under the direction of a Professional Engineer licensed in New York State. Soils samples were classified in accordance with the Unified Soil Classification System (ASTM D2488) and a modified Burmister soil classification system. Copies of the boring logs are included in Appendix I.

5.0 LABORATORY TESTING

Laboratory testing was performed on select soil and rock core samples to assist in evaluating their engineering properties and to verify field identifications. Testing included the performance of eight (8) gradation analyses in accordance with ASTM Standard D6913. The results of the laboratory testing are included in Appendix I.

6.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered at the site generally consist of approximately 3- to 9-inches of topsoil-like material underlain by fill, native soils, and relatively shallow bedrock. The following subsections provide generalized descriptions of the of the encountered soil, bedrock, and groundwater conditions. Detailed descriptions of the subsurface conditions are provided in the boring logs included in Appendix I.

As noted above, an automatic hammer was used in the SPT sampling of the borings. Given that an automatic hammer imparts more energy into the split-spoon sampler than a safety hammer (the standard hammer used for most geotechnical engineering calculations), an energy correction factor of 1.3 is applied to the field N-values to obtain the energy corrected (N_{60}) values.

6.1 Fill

A variable layer of existing fill, extending approximately 1 to 8 feet bgs, was encountered within the boring locations, corresponding to approximate elevations of +194 to +203 feet. The fill thickness is generally consistent at 1 to 2 feet across most of the site, however, was observed to extend deeper at both the southern and northwestern edge of the proposed building footprint, at up to 5 and 8 feet, respectively. Borings B-1 and B-2, located near the southern edge of the proposed building, indicated fill depths of up to 5 feet, bound at the base by a layer of cobbles. Boring B-6, located at the northwest edge of the proposed building, contained fill material to depths of approximately 8 feet bgs.

The fill ranges in color from brown to red-brown and generally consists of a mixture of coarse to fine sand, or slightly plastic fines, with lesser amounts of coarse to fine gravel, and cobbles. Where the fill is dominated by clayey silt, it was observed to contain up to 45 percent coarse to fine sand, and up to 10 percent coarse to fine gravel. Where dominated by coarse to fine sand, up to 45 percent clayey silt, and 20 percent coarse to fine gravel. Cobbles were encountered within the fill in borings B-1 and B-2 at approximate depths of 5 feet and 2 feet, respectively. The cobbles, where encountered, appear to

be located at the base of the fill material. The fill appears to be a mixture of reworked native soil and imported material. The fill soils have USCS designations of GP, SM, and ML.

Field SPT N-values within the fill range from 3 to 17 blows per foot (bpf), excluding the split-spoon refusal encountered within the fill at boring B-2 at a depth of 1-foot (>50 bpf). When the energy correction for the use of an automatic hammer is applied to the field N-values shown on the boring logs, the N_{60}-values within the fill range from 4 to 22 bpf, indicating the fill is in a very loose to loose condition.

6.2 Native Soils

A review of the most recent surficial geology mapping (NYSM, Surficial Geologic Map of New York, Lower Hudson Sheet, 1989) indicates that the site is underlain by glacial till. Glacial till is a mixed soil with a very wide range of particle sizes, ranging from clay to boulders, produced by the continental glacier that covered the area up until approximately 15,000 years ago. Based on our observations of the soil encountered immediately below the fill, the native soils appear to largely consist of glacial till, consisting of a variable mixture of gravel, sand, and slightly plastic fines. Generally, the till was observed to range in color from brown to red & gray-brown and was observed to be dominated by coarse to fine sand, with 20 to 45 percent clayey silt, and 10 to 25 percent coarse to fine gravel; or dominated by silt, with 30 to 45 percent coarse to fine sand, and 10 to 25 percent coarse to fine gravel. Additionally, samples of gravel dominated till were encountered near the base of the native soil layer, indicative of a weathered bedrock transition zone. Mottling, the discoloration of the fine-grained native soils due to prolonged saturation, was observed within boring B-5, at a depth of 4 to 6 feet bgs. As the groundwater table was not encountered within the borings, mottling at this depth likely indicates the presence of localized trapped, or perched, groundwater within the fine-grained soils.

Field SPT N-values within the fill range from 9 to 84 bpf, which correlate to N_{60}-values ranging from 12 to 109 bpf. These N_{60}-values indicate the native glacial till soils are highly variable and in a loose to very dense condition. It should be noted that within boring B-6, located at the northwest edge of the proposed building, N_{60}-values observed within the native till, from depths of approximately 8 to 12 feet bgs, were relatively low (loose to medium dense) compared to the site average for this native material.

6.3 Bedrock

Bedrock was encountered and confirmed by core sampling within borings B-3, B-5, B-6, and B-7 at depths of 14.5, 9.5, 16, and 15 feet bgs, respectively. Bedrock was inferred by split-spoon and auger refusal at the remaining boring locations. Top of confirmed, and inferred, bedrock correspond to approximate elevations of +185 to +193.

A review of the most recent regional bedrock geology maps (NYSM, Geologic Map of New York, Lower Hudson Sheet, 1995) indicates the underlying bedrock is comprised of the Brunswick Formation, containing varied sedimentary units including sandstone, siltstone, mudstone, and conglomerate. From the core samples collected, the bedrock consists of gray to red-brown, slightly weathered, moderately fractured, sandstone and siltstone. The four (4) rock core samples collected had an average rock quality designation (RQD) of 27 percent and an average recovery of 54 inches from each of the 60-inch core runs, indicating the bedrock is generally of poor quality.

6.4 Groundwater

Groundwater was not observed within groundwater observation well OW-1, which extended to the approximate top of bedrock at a depth of 13', corresponding to an approximate elevation of +191 feet. Additionally, saturated soils were not observed in samples collected from the borings. As noted above, within boring B-5, at a depth of 4 to 6 feet bgs, mottling was observed within one sample, likely indicating a localized pocket of trapped water within the fine-grained soils. It is noted that although groundwater was not encountered at the time of this investigation, groundwater levels fluctuate seasonally and with changing weather conditions. Therefore, groundwater should be expected to be encountered at varied depths pending these conditions.

7.0 SEISMIC SITE COEFFICIENTS AND LIQUEFACTION POTENTIAL

Based on the results of the subsurface investigation, and the criteria outlined in the current edition of the Code, the subsurface conditions underlying the site should be considered Seismic Site Class C. This classification, in conjunction with the Client provided Seismic Risk Category for the proposed structure, III, requires maximum spectral response accelerations at short periods (Sm_s) equal to 0.385g and at 1-second periods (Sm_1) equal to 0.092g. The corresponding five percent damped design spectral response acceleration at short periods (S_{DS}) is equal to 0.257g and at 1-second (S_{D1}) 0.062g.

Liquefaction of soils can be caused by strong vibratory motion due to earthquakes. Both research and historical data indicate that loose, granular soils saturated by a shallow groundwater table are most susceptible to liquefaction. Liquefaction occurs when an earthquake and associated ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid increase in pore-water pressure, causing the soil to behave as a fluid for short periods. Due to the combination of depth to groundwater, the relative density and fines content of the soil, and the observation that the fines are slightly plastic, the site soils are unlikely to liquefy during the design earthquake event.

8.0 DISCUSSION AND CONCLUSIONS

Construction of the proposed building within the site is feasible from a geotechnical standpoint. The primary geotechnical issues associated with the proposed construction are the presence of shallow fill material and relatively shallow bedrock.

It is our understanding from the Client provided project drawings, "Rockland BOCES P-Tech C-Tech Building", Sheet C-101, dated May 17, 2024, that the proposed building will have a finished floor elevation (FFE) of +204 feet. Additionally, from email conversations with KSQ Design and GACE Consulting Engineers, as well as the provided progress set of structural drawings entitled "Rockland BOCES P-Tech C-Tech Building", Sheets S-001 to S-301, dated August 27, 2024, the building will include an elevator pit extending approximately 5 feet below top of slab elevation and will not otherwise include a basement. Therefore, assuming a shallow foundation system will be utilized, it is anticipated that the estimated footing bearing elevations of the proposed building will be approximately 4 to 6 feet below FFE, corresponding to elevations of approximately +200 to +198 feet. It is anticipated that slabs will bear approximately 1 to 2 feet below proposed FFE, corresponding to elevations of approximately +203 to +202 feet. The elevator pit is anticipated to bear at an approximate elevation of +199 feet.

At the estimated range of foundation bearing elevations, predominantly loose to dense native soil will be encountered with the exception of localized zones at the southern and northwestern proposed building footprint where deeper fill was encountered. At the estimated range of slab bearing elevations, it is anticipated that up to 2 feet of structural fill will be required to raise existing grades to meet the proposed finished floor elevation of +204 feet; however, at the higher elevation portions of the site, slab subgrades will consist of existing fill.

Due to the presence of high fines contents, subsequent moisture susceptibility, and the very loose to loose soil conditions, the fill should not be considered suitable subgrade for foundation bearing elements (spread footings, strip footings, grade beams) and will require excavation and replacement with suitable compacted structural fill where encountered.

At the estimated range of slab bearing elevations, the existing fill, generally 1to 2-feet thick within the majority of the slab area, may provide suitable subgrades for placement of structural fill under slab areas. As mentioned above, the fill appears to be a mixture of native and imported soils likely placed during adjacent construction or grading of the existing lawn area. No deleterious materials were observed within the fill at the boring locations. It is understood that the interior of the proposed building will be heated and therefore frost susceptibility at interior slab subgrades is less of a concern. Preparation of these fill slab subgrades for placement of structural fill will require significant precautions pertaining to temporary support of construction equipment, moisture, and freezing due to the loose relative density and high fines content present. Due to relatively high fines content of the existing fill and native till soils, they should be considered sensitive to disturbance during excavation and/or compaction, when exposed to water. Therefore, it is critical that care be taken during subgrade preparation to prevent undue saturation of the soils. Upon excavation, slab subgrades should be inspected to verify that no deleterious material is present. Alternatively, to avoid potential construction difficulties with existing fill slab subgrades, existing fill could be excavated and replaced to the top of suitable native till. As discussed above, the general depth of this fill within the slab area is anticipated to typically be between 1 to 2 feet.

The following are other general conclusions that can be made regarding the proposed construction:

- Excavations into the fill and native soils should be feasible with conventional heavy-duty construction equipment; however, cobbles and boulders should be expected.

- Groundwater will likely not be encountered during foundation excavation. However, due to the moisture susceptibility of site soils surface runoff and moisture mitigation of subgrade soils will be required.

- Laboratory testing of the near-surface soils and field classification indicate that some portions of the fill and native soils contain predominantly fine-grained soils. Such fine-grained soils are highly moisture susceptible, and therefore suggests that portions of the existing fill and native soils may not be stable when wet. Consequently, subgrade protection, such as crushed stone or a mud mat may be required to prevent weakening of subgrade soils during construction.

- It is not anticipated that the on-site soils will be suitable for structural fill due to their fines contents.

- The site falls under Seismic Site Class C and it is anticipated, due to the relatively high fines content and density of the glacial till, the site is not likely to liquefy during the design earthquake event. Lateral soil flow, slope instability, and surface rupture are not considered viable seismic hazards at the project site.

- Monitoring should be performed to document that the construction does not adversely impact the existing structures around the site. Pre and post construction condition surveys should be performed to document existing conditions of the adjacent structures. Pending the results of the building condition surveys, monitoring may surveying to identify both horizontal and vertical movement as well as measuring vibration levels during construction to document that they are within acceptable limits.

9.0 RECOMMENDATIONS

The following sections provide our geotechnical recommendations for design of the proposed building foundations. The recommendations are based on our understanding of the proposed construction, as described in Section 3, the results of the subsurface investigation, and our experience in the general vicinity of the project site.

9.1 Spread and Continuous Wall Footings

The proposed building can be supported on spread footings and continuous frost wall foundations, both interior and exterior, that bear on undisturbed medium dense to very dense native till soils or on structural fill placed over these materials. Existing fill soils are considered unsuitable subgrades for spread and continuous wall footings. Building foundations should be designed using an allowable bearing capacity of 3,000 pounds per square foot (psf). Perimeter (exterior) foundations should bear at least 4 feet below proposed exterior grade. Interior foundations may bear at minimum depth of 2 feet below existing finished floor elevation. Continuous footings should have a minimum width of 2 feet and spread footings should have a minimum width of 3 feet. Using the above design criteria, total settlement is estimated to be less than 1.0 inch and differential settlements, estimate over a distance of approximately 30 feet, are estimated to be less than 0.5 inches.

9.2 Slab-On-Grade Floors

Slab-on-grade floors should be supported on a minimum 6-inch-thick layer of free draining ½ to ¾ inch crushed stone placed over the compacted existing fill, native till soil, or structural fill placed over existing fill or native soil. Slab subgrades should be compacted with a minimum of five (5) passes, in each direction, with a 10-ton roller. A moisture barrier is recommended for the first-floor slab-on-grade. A coefficient of friction of 0.3 should be used when incorporating a waterproofing or moisture proofing membrane.

For design of slab-on-grade floors with a 6-inch crushed stone base, a modulus of subgrade reaction of 100 pounds per cubic inch (pci) is recommended when bearing on existing fill, native soil, or compacted structural fill placed over a proof-rolled and approved existing fill subgrade. The structural fill should have a minimum thickness of 6 inches. Design should be in accordance with the latest edition of the American Concrete Institute (ACI 360). The modulus of subgrade reaction is suitable for estimating distributions of bearing pressure beneath the slab and for estimating bending moments and shear stress within the slab. It is not intended for the purpose of calculating total of differential settlements.

9.3 Design for Lateral Loading of Walls

Basement walls and temporary shoring should be designed in accordance with the following criteria:

Soil Parameter	Structural Fill	Native Soil	Existing Fill
Angle of Internal Friction	34°	32°	30°
Active Earth Pressure Coefficient (Ka)[1]	0.28	0.31	0.33
Passive Earth Pressure Coefficient (Kp)[2]	3.54	3.25	3.00
At-Rest Earth Pressure Coefficient (Ko)[3]	0.44	0.47	0.5
Unit Weight of Soil (pounds per cubic foot)	130	125	120

1) Use for free standing walls where movement of up to 0.0015 X height of wall is both possible and tolerable. Otherwise, use at-rest coefficient.

2) Assume passive pressure below a depth of 4 feet below exterior grade only.

3) Use for walls restrained against outward lateral movement.

Additional loading due to temporary and permanent surcharges should be added to the lateral loading exerted by the retained soil. Loads due to supported structures should be applied in appropriate combinations with the lateral loads.

Consideration should be given to the inclusion of perimeter foundation wall drainage systems. If utilized, perimeter drainage measures should consist of a minimum 12-inch-wide drainage layer of crushed stone or clean gravel placed against the full-height of the foundation wall with a collector pipe at the footing bottom draining to a positive outlet. The collector pipe at the bottom of the footing should drain to a suitable outlet. Alternatively, a geocomposite drainage board can be utilized. The gradation

specification for the drainage material is provided in Section 10.3 as "free draining crushed stone." The stone or gravel should be completely separated from the soil backfill by a permeable geotextile having an apparent opening size the equivalent of a No. 70 to 100 U.S. Sieve. Grading of the surface of the backfill and the surrounding topography and pavements should provide positive drainage away from the walls. Roof drains should be positively drained to areas away from the building.

Walls should be backfilled in accordance with Section 10 of this report. Placement and compaction of backfill should be observed and tested by a geotechnical engineer to monitor that proper compaction is being achieved.

9.4 Design of Rock Anchors

Use of rock anchors as foundation tie-down elements is feasible. The top of bedrock was generally encountered at relatively shallow depths between 8.5 to 16 feet bgs, corresponding to approximate elevations of +185 to +193 feet. Rock anchors should be bonded within competent sedimentary bedrock as observed within the borings and designed using an ultimate rock-grout design bond capacity of 80 psi.

10.0 EARTHWORK CONSTRUCTION CRITERIA

The following sections present our recommendations regarding earthwork and construction monitoring.

10.1 General Site Preparation

The site should be cleared and grubbed, and demolition should include the removal of all debris. Debris and vegetation from the clearing operations should be removed from the site and disposed of at a legal dump site. Any existing utilities within the project limits should be excavated and re-routed or removed. The resulting excavations should be backfilled with structural fill.

10.2 Subgrade Preparation

All subgrades should be inspected by the geotechnical engineer prior to the placement of structural fill or concrete. Subgrades should consist of the materials identified in Section 9.1. All subgrades to receive fill should be proofrolled under the observation of the geotechnical engineer. Proofrolling should be accomplished by making a minimum of 4 passes in perpendicular directions with a 10-ton

roller in open areas and a 1.5-ton trench roller where access is confined. Proofrolling should not be performed on saturated soils or in areas having freestanding surface water, until they are dewatered and allowed to dry. Proofrolling soils that exceed the optimum moisture content may result in more unfavorable conditions. Unsuitable materials or areas identified to be loose or soft by the geotechnical engineer, based on visual inspection and observation of proofrolling operations, should be removed and replaced with compacted structural fill and/or concrete as directed by the inspecting engineer.

The site soils have some frost heave susceptibility. Full protection against frost heave generally requires removing frost susceptible soils to maximum depth of anticipated frost penetration, which is 4 feet. This is typically expensive and not performed. Partial protection against frost heave can be achieved by replacing some fraction of the frost zone with non-frost susceptible soils. To this end, we recommend that non-frost susceptible soils be placed to a minimum depth of 18 inches below top of pavement. This can consist of structural fill. Undercut subgrades for pavement should be proofrolled and approved as described above. Remedial removals should be performed as directed by the inspecting engineer.

10.3 Fill and Backfill Materials

Structural fill should consist of sand, gravel or crushed stone or a mixture of these with no organic or other deleterious matter. Structural fill should conform to the following gradation:

Sieve Size	Percent Finer by Weight
2 inch	100
¼ inch	30-70
No. 40	5-40
No. 200	0-10

Most of the existing site existing site soils are not suitable for use as structural fill due to excessive fines contents. Some of the more competent shale bedrock may possibly be processed into suitable structural fill.

All structural fill should be compacted to at least 95 percent of the maximum dry density at near optimum moisture contents as determined by ASTM Standard D1557, *"Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))".* The lift

thickness for the fill soils will vary depending on the type of compaction equipment used. Fills should generally be placed in uniform horizontal lifts not exceeding 8 inches in loose thickness in open areas. In confined areas, the loose lift thickness should be reduced to 4 inches or less and each lift should be compacted with sufficient passes of hand operated vibratory or impact compaction equipment. Compaction within 5 feet of foundation walls should only be performed with hand-operated equipment.

A geotechnical engineer with appropriate field and laboratory support should approve materials for use as fill, and test backfill materials for compliance with the recommended compaction. Each lift of fill placed at the site should be tested for compaction.

Free draining crushed stone placed below floor slabs and as drainage materials should be Underdrain Filter Type I materials as specified in the New York State Department of Transportation Standard Specifications as follows:

Sieve Size	Percent Finer by Weight
1 inch	100
1/2 inch	30 – 100
1/4 inch	0 – 30
No. 4	0 – 10
No. 8	0 – 5

10.4 Construction Dewatering and Protection of Subgrades

Approved subgrades should be protected from the effects of frost, construction traffic, perched groundwater, surface water and precipitation. The necessary protection should be provided as soon after acceptance as is practicable and should be maintained until coverage with compacted fill or concrete. Although groundwater was not observed within the investigation, seasonal and weather-related fluctuations may raise groundwater levels and dewatering may be anticipated accordingly.

As noted, the on-site soils are moisture sensitive. They will readily soften and experience a reduction in load-carrying capacity when exposed to moisture and disturbed by construction traffic and foot traffic. Additional excavation and material removal may be required if subgrades are allowed to be exposed for long durations without fill or concrete placement. Subgrades may be protected from undue moisture and traffic during construction with a layer of crushed stone, waterproof covers, or mud mat where viable.

10.5 Excavations and Shoring

Temporary excavation slopes should conform to the latest OSHA standards, including slopes permitted for specified heights and soil conditions encountered. Adequate dewatering operations should be in-place prior to excavation to prevent slopes from sloughing to a flatter inclination. The presence of perched water, or other deleterious materials could require flatter slopes or temporary excavation support (e.g., shoring and bracing). Excavation support may also be necessary in areas where sufficient distance to provide adequate benching of slopes is not available. Design of dewatering and excavation support should conform to the latest OSHA and other applicable agency requirements. Design of all excavation slopes greater than a 4-foot depth and design of sheeting, shoring, and bracing should be performed by a New York State licensed Professional Engineer. The existing site soils should be considered OSHA Type C soils.

Pre-construction and post-construction building condition surveys should be considered to document existing conditions of the neighboring structures. Pending the results of the aforementioned pre-construction building condition survey, a monitoring program may also be considered.

11.0 CONSTRUCTION MONITORING

A geotechnical engineer familiar with the existing subsurface conditions and having the appropriate laboratory and field testing support should be engaged by the owner to observe that all earthwork is performed in accordance with the specifications, the Code, and the criteria provided in this report. As a minimum the following work should be performed under the observation of the geotechnical engineer:

- Pre-existing conditions survey and monitoring of adjacent buildings
- Subgrade preparation and remedial removal of existing fill where required
- Placement and compaction of fill and backfill materials

All materials proposed for use as soil fill should be tested and approved prior to delivery to the site. Additionally, all fill materials should be tested as they are being placed to verify that the required compaction is achieved. We further recommend that the project plans and specifications be reviewed by the geotechnical consultant prior to final completion of the bid documents. It should be noted that upon review of those documents, some recommendations presented herein may be revised or modified.

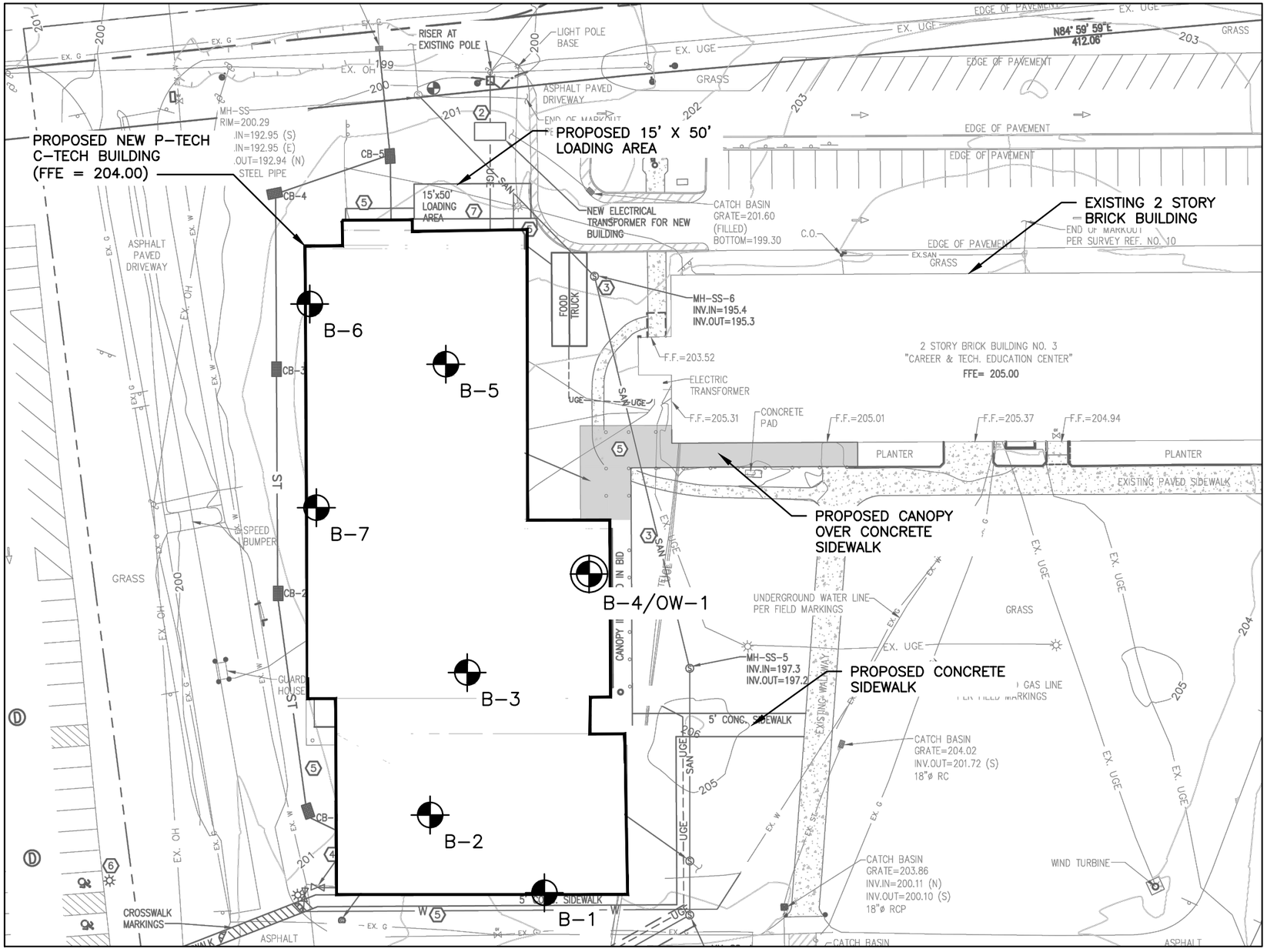
12.0 LIMITATIONS

Our professional services have been performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers and geologists practicing in this or similar situations. The interpretation of the field data is based on good judgment and experience. However, no matter how qualified the geotechnical engineer or detailed the investigation, subsurface conditions cannot always be predicted beyond the points of actual sampling and testing. No other warranty, expressed or implied, is made as to the professional advice included in this report. The recommendations contained in this report are intended for design purposes only. Contractors and others involved in the construction of this project are advised to make an independent assessment of the soil and groundwater conditions for the purpose of establishing quantities, schedules and construction techniques.

This report has been prepared for specific application to the proposed construction detailed in this report. We recommend that prior to construction; Tectonic Engineering & Surveying Consultants P.C. reviews the project plans and specifications. It should be noted that upon review of those documents, some recommendations presented herein might be revised or modified. In the event that any changes in the design or location of the proposed structures are planned, Tectonic shall not consider the conclusions and recommendations contained in this report valid unless reviewed and verified in writing. It is further recommended that Tectonic be retained to provide construction monitoring and inspection services to ensure proper implementation of the recommendations contained herein, which would otherwise limit our professional liability.

MJP, CBB: G:\Newburgh\Geotechnical\12600\12651.01 Rockland BOCES PTECH Building\Report\12651.01 Rockland BOCES_Geotechincal Report.docx

FIGURE I



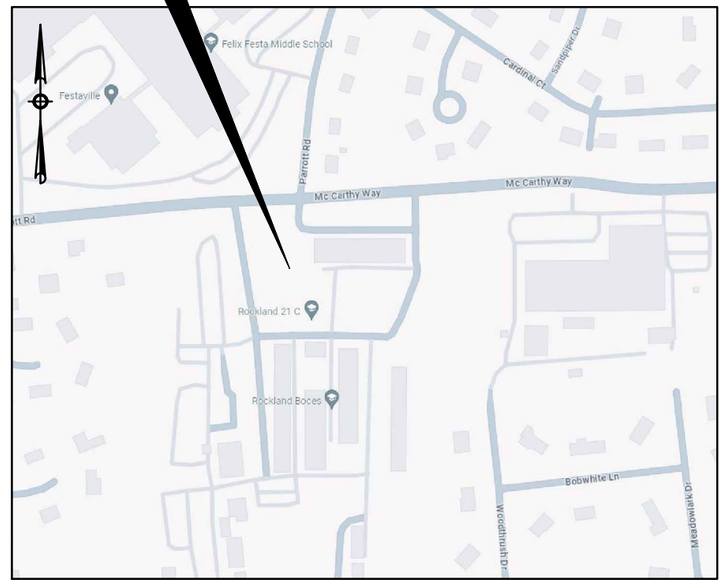
LEGEND

- B-7 — APPROXIMATE BORING LOCATION
- B-4/OW-1 — APPROXIMATE GROUNDWATER OBSERVATION WELL LOCATION

NOTES

1. PLAN BASED ON A DRAWING PROVIDED BY THE CLIENT, ENTITLED "ROCKLAND BOCES P-TECH C-TECH BUILDING", SHEET NUMBER C-101, DATED 05/17/2024.
2. THE BORING AND GROUNDWATER OBSERVATION WELL LOCATIONS WERE FIELD LOCATED BY TECTONIC AND SHOULD BE CONSIDERED APPROXIMATE.

SITE



0 1 2 3

ORIGINAL SIZE IN INCHES

Tectonic

PRACTICAL SOLUTIONS. EXCEPTIONAL SERVICE.

Tectonic Engineering Consultants, Geologists & Land Surveyors, D.P.C.
70 Pleasant Hill Road
P.O. Box 37
Mountainville, NY 10953
Phone: (845) 534-5959
(800) 829-6531
www.tectonicengineering.com

Project Contact Info
1279 Route 300
Newburgh, NY 12550
Phone: (845) 567-6656

BORING AND GROUNDWATER OBSERVATION WELL LOCATION PLAN

ROCKLAND BOCES
PROPOSED NEW P-TECH C-TECH BUILDING
65 PARROT ROAD
WEST NYACK, ROCKLAND COUNTY, NEW YORK

Date	Work Order	Drawing No.	Rev
08/27/2024	12651.01	FIGURE 1	0
Scale 1" = 50'			

APPENDIX I

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-1

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **14.2'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | | TO
CME 55 Track Rig with Automatic Hammer

GROUND WATER | DATE | TIME | DEPTH
MON. WELL ☐ YES ☒ NO
SCREEN DEPTH: --- TO ---
WEATHER: **Overcast** TEMP: **80° F**
DEPTH TO ROCK: **14.2'**
*CHANGES IN STRATA ARE INFERRED

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **203.5**
DATUM: **See Remarks**
DATE START: **8/6/24**
DATE FINISH: **8/6/24**

UNCONFINED COMPRESS. STRENGTH (TONS/FT) ● 1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % ✕ ⊗ △ 10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) ● 10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLES: SAMPLE NUMBER	RECOV. LENGTH (IN.)	RECOV. RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
1	17	2 9 8 5	S-1	20		M	SM	6" Topsoil-like material Bwn c-f SAND, and Silt, trace f Gravel (FILL)		
3								Drilled through 8" cobbles to 5' bgs (FILL)		
5										198.5
6	27	14 10 17 15	S-2	5		M	SM	Bwn c-f SAND, and Silt, trace f Gravel		
8	25	10 12 13 10	S-3	2		M	SM	Same		
10	9	4 5 4 5	S-4	21		M	SM	Rd-bwn m-f SAND, and Silt, trace f Gravel		193.5
12	84+	12 34 50/5	S-5	13		M	SM	Same		84
14	50+	50/2	S-6	1		M	SP	Bwn-rd c-f SAND, and Gravel, trace Silt (residual soil) Spoon and auger refusal @ 14.2' bgs on apparent bedrock		
								End of Boring at 14.2'		188.5
15										
20										183.5
25										178.5

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-2

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **8.5'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | | TO
CME 55 Track Rig with Automatic Hammer

GROUND WATER | DATE | TIME | DEPTH

MON. WELL ☐ YES ☒ NO
SCREEN DEPTH: **---** TO **---**
WEATHER: **Clear** TEMP: **80° F**
DEPTH TO ROCK: **8.5'**
*CHANGES IN STRATA ARE INFERRED

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **202.0**
DATUM: **See Remarks**
DATE START: **8/6/24**
DATE FINISH: **8/6/24**

UNCONFINED COMPRESS. STRENGTH (TONS/FT) ● 1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % 10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) ● 10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLES: SAMPLE NUMBER	RECOV. LENGTH (IN.)	RECOV. RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
1	50+	5 50/1	S-1	1		M	GP	3' Topsoil-like material Gy-bwn GRAVEL, trace c-f Sand, trace Silt (FILL)		
2										
3								Augered through 8" cobbles		
4										
5	33	26 21 12 15	S-2	20		M	SM	Bwn-gy c-f SAND, and Silt, some c-f Gravel		197.0
6										
7	50+	28 50/4	S-3	7		M	GM	Bwn c-f Gravel, some c-f Sand, little Silt Gy-bwn-rd c-f GRAVEL, some c-f Sand, little Silt		
8	50+	50/5	S-4	4		M	GM	Spoon and auger refusal @ 8.5' on apparent bedrock		
9										
10								End of Boring at 8.5'		192.0
11										
12										
13										
14										
15										187.0
16										
17										
18										
19										
20										182.0
21										
22										
23										
24										
25										177.0

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-3

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **14.5'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | | TO
CME 55 Track Rig with Automatic Hammer

GROUND WATER | DATE | TIME | DEPTH
MON. WELL ☐ YES ☒ NO
SCREEN DEPTH: **---** TO **---**
WEATHER: **Clear** TEMP: **85° F**
DEPTH TO ROCK: **14.5'**
*CHANGES IN STRATA ARE INFERRED

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **202.5**
DATUM: **See Remarks**
DATE START: **8/6/24**
DATE FINISH: **8/6/24**

UNCONFINED COMPRESS. STRENGTH (TONS/FT) 1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % 10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) 10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLES: SAMPLE NUMBER	RECOV. LENGTH (IN.)	RECOV. RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
0								6' Topsoil-like material		202.5
1	3	1 1 2 3	S-1	10		M	ML	Bwn SILT, and f Sand, little f Gravel (FILL)		
2										
3	69	20 31 38 50	S-2	13		M	GP	Gy c-f GRAVEL, trace c-f Sand, trace Silt		
4	50+	50/5	S-3	2		M	GP	Same		
5										197.5
6										
7	39	14 19 20 20	S-4	20		M	SM	Bwn Silt, some c-f Sand, some f Gravel		
8										
9	35	15 13 22 23	S-5	10		M	ML	Same		
10										192.5
11	36	18 19 17 12	S-6	21		M	ML	Dk Bwn-rd SILT, and c-f Sand, little c-f Gravel		
12										
13										
14	50+	50/1	S-7	1		M		Weathered Sandstone bedrock		
15	1.12									187.5
16	1.26									
17	1.35		C-1	60	53			Rd-bwn, lightly weathered, moderately fractured, SANDSTONE, visible conglomerates in core m-f grained		
18	1.36									
19	1.36									
20								End of Boring at 19.5'		182.5
21										
22										
23										
24										
25										177.5

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-4

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **13'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | | TO
CME 55 Track Rig with Automatic Hammer

GROUND WATER

DATE	TIME	DEPTH
8/7/24	**10:30 am**	**NE**
8/8/24	**11:30 am**	**NE**

MON. WELL [X] YES [ ] NO
SCREEN DEPTH: **3** TO **13'**
WEATHER: **Rain** TEMP: **80° F**
DEPTH TO ROCK: **13'**
*CHANGES IN STRATA ARE INFERRED

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **204.0**
DATUM: **See Remarks**
DATE START: **8/7/24**
DATE FINISH: **8/7/24**

UNCONFINED COMPRESS. STRENGTH (TONS/FT) ◓
1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) ●
10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLE NUMBER	RECOV. LENGTH (IN.)	RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
0								9" Topsoil-like material		
1	9	1, 2, 7, 9	S-1	17		M	ML	Rd-bwn SILT, and m-f Sand, little f Gravel		
2										
3	22	11, 12, 10, 14	S-2	24		M	SM	Rd-bwn c-f Sand, and Silt, little f Gravel		
4										
5	42	24, 24, 18, 11	S-3	22		M	SM	Same		199.0
6										
7	29	10, 15, 14, 12	S-4	18		M	SM	Rd-bwn c-f Sand, and Silt, little f Gravel		
8										
9	18	8, 9, 9, 12	S-5	17		M	SM	Rd-bwn m-f SAND, some Silt, little c-f Gravel (weathered rock)		
10										194.0
11	25	14, 11, 14, 9	S-6	11		M	GM	Rd-bwn c-f GRAVEL, little c-f Sand, little Silt (weathered rock)		
12								Spoon and auger refusal @ 13' on apparent bedrock		
13										
14								End of Boring at 13'		
15										189.0
16										
17										
18										
19										
20										184.0
21										
22										
23										
24										
25										179.0

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-5

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **9.5'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | **2"** | **9.5** TO **14.5'**
CME 55 Track Rig with Automatic Hammer

GROUND WATER | DATE | TIME | DEPTH

MON. WELL ☐ YES ☒ NO
SCREEN DEPTH: **---** TO **---**
WEATHER: **Rain** TEMP: **75° F**
DEPTH TO ROCK: **9.5'**
*CHANGES IN STRATA ARE INFERRED

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **203.5**
DATUM: **See Remarks**
DATE START: **8/7/24**
DATE FINISH: **8/7/24**

UNCONFINED COMPRESS. STRENGTH (TONS/FT) ● 1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % ✕ ⊗ △ 10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) ● 10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLES: SAMPLE NUMBER	RECOV.: LENGTH (IN.)	RECOV.: RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
1	6	1 2 4 7	S-1	19		M	SM	Rd-bwn Silt, and m-f Sand, trace f Gravel (FILL)		
3	18	9 9 9 7	S-2	22		M	ML	Bwn-rd SILT, some m-f Sand, little f Gravel		
5	22	5 5 17 15	S-3	24		M	ML	Bwn SILT, some m-f Sand, little c-f Gravel, Mottled		198.5
7	35	30 22 13 7	S-4	8		M	GP	Gy-bwn-rd c-f GRAVEL, little c-f Sand, trace Silt		
9	50+	7 50/3	S-5	10		M	GM	Gy-bwn-rd c-f GRAVEL, little c-f Sand, little Silt		
10	1.15									193.5
11	1.15									
12	1.15		C-1	55	6			Bwn-gy-rd fractured, moderately weathered, SANDSTONE		
13	1.20									
14	1.20									
15								End of Boring at 14.5'		188.5
20										183.5
25										178.5

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-6

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **16'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | **2"** | **16** TO **21'**
CME 55 Track Rig with Automatic Hammer

GROUND WATER | DATE | TIME | DEPTH

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **202.0**
DATUM: **See Remarks**
MON. WELL ☐ YES ☒ NO
SCREEN DEPTH: **---** TO **---**
DATE START: **8/7/24**
WEATHER: **Overcast** TEMP: **75° F**
DATE FINISH: **8/8/24**
DEPTH TO ROCK: **16'**
*CHANGES IN STRATA ARE INFERRED

UNCONFINED COMPRESS. STRENGTH (TONS/FT) ● 1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % ✕ ⊗ △ 10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) ● 10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLES: SAMPLE NUMBER	RECOV. LENGTH (IN.)	RECOV. RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
1-2	7	1 2 5 6	S-1	14		M	SM	Bwn c-f SAND, and Silt, little f Gravel (FILL)		
3-4	11	17 5 6 6	S-2	10		M	SM	Bwn-rd m-f SAND, and Silt, trace f Gravel (FILL)		
5-6	5	5 3 2 2	S-3	12		M	SM	Rd-bwn m-f Sand, some Silt, some c-f Gravel (FILL)		197.0
7-8	7	1 2 5 8	S-4	8		M	SM	Bwn-rd-gy c-f SAND, and Gravel, little Silt (FILL)		
9-10	18	6 6 12 8	S-5	21		M	SM	Bwn-rd m-f SAND, some Silt, trace c-f Gravel		192.0
11-12	8	3 3 5 4	S-6	12		M	SM	Bwn-rd c-f Sand, and Silt, little c-f Gravel		
13-14										
15-16	50+	50/4	S-7	4		M	SM	Same		187.0
17-21	1.30 1.45 2.0 2.0 2.0		C-1	51	41			Gy-rd-bwn, slightly weathered, moderately fractured, c grained SANDSTONE		182.0
22-25								End of Boring at 21'		177.0

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

Tectonic

PROJECT No. **12651.01**
PROJECT: **Rockland BOCES PTECH CTECH Building**
LOCATION: **West Nyack, NY**

BORING No. B-7

SHEET No. 1 of 1

CLIENT: **KSQ Design**
CONTRACTOR: **Core Down Drilling LLC**
METHOD OF ADVANCING BORING | DIA. | DEPTH
POWER AUGER: | **3 1/4"** | **0** TO **15'**
ROT. DRILL: | | TO
CASING: | | TO
DIAMOND CORE: | **2"** | **15** TO **20'**
CME 55 Track Rig with Automatic Hammer

GROUND WATER | DATE | TIME | DEPTH
| | | |

MON. WELL ☐ YES ☒ NO
SCREEN DEPTH: **---** TO **---**
WEATHER: **Overcast** TEMP: **75° F**
DEPTH TO ROCK: **15'**
*CHANGES IN STRATA ARE INFERRED

INSPECTOR: **Connor McCleary**
DRILLER: **Andrew Bellucci**
SURFACE ELEVATION: **202.0**
DATUM: **See Remarks**
DATE START: **8/8/24**
DATE FINISH: **8/8/24**

UNCONFINED COMPRESS. STRENGTH (TONS/FT) ● 1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % ✕ ⊗ △ 10 20 30 40 50
STANDARD PENETRATION (BLOWS/FT.) ● 10 20 30 40 50

DEPTH (FT.)	N OR MIN./FT.	PENETRATION RESISTANCE (BL/6 IN.)	SAMPLES: SAMPLE NUMBER	RECOV.: LENGTH (IN.)	RECOV.: RQD (%)	MOISTURE	UNIFIED SOIL CLASS.	DESCRIPTION OF MATERIAL	LITHOLOGY*	ELEVATION (FT.)
1	5	1 1 4 5	S-1	16		M	SM	Rd-bwn m-f SAND, and Silt, little c-f Gravel (FILL)		
3	15	6 11 4 3	S-2	14		M	SM	Rd-bwn SILT, and m-f Sand, trace f Gravel		
5	9	3 4 5 8	S-3	8		M	ML	Rd-bwn SILT, and m-f Sand, trace f Gravel		197.0
7	36	12 14 22 17	S-4	17		M	ML	Same		
9	42	15 16 26 20	S-5	24		M	GM	Rd-bwn c-f GRAVEL, some Silt, some m-f Sand (weathered rock)		192.0
11	18	17 9 9 7	S-6	12		M	GM	Same		
13										
15										187.0
16	1.35									
17	2.0									
18	2.0		C-1	52	8			Bwn-rd m-f grained, moderately weathered, very fractured, SILTSTONE		
19	2.0									
20	1.45									182.0
21								End of Boring at 20'		
22										
23										
24										
25										177.0

REMARKS: Surface elevations are estimated based on the Client provided drawing.

BORING LOG 12651.01.GPJ TECTONIC ENG.GDT 9/12/24

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LEGEND FOR SOIL DESCRIPTION

COARSE GRAINED SOIL (Coarser then No. 200 Sieve)

DESCRIPTIVE TERM & GRAIN SIZE

TERM	SAND					GRAVEL
coarse - c	No.	4	Sieve to No.	10	Sieve	3" to 3/4"
medium - m	No.	10	Sieve to No.	40	Sieve	3/4" to 3/16"
fine - f	No,	40	Sieve to No.	200	Sieve	

COBBLES 3" to 10"

BOULDERS 10" +

GRADATION DESIGNATIONS	PROPORTIONS OF COMPONENT
fine, f	Less than 10% coarse to medium
medium to fine, m-f	Less than 10% coarse
medium, m	Less than 10% coarse and fine
coarse to medium, c-m	Less than 10% fine
coarse, c	Less than 10% medium and fine
coarse to fine, c-f	All greater than 10%

FINE GRAINED SOIL (Finer than No. 200 Sieve)

DESCRIPTION	PLASTICITY INDEX	PLASTICITY
Silt	0 - 1	none
Clayey Silt	2 - 5	slight
Silt & Clay	6 - 10	low
Clay & Silt	11 - 20	medium
Silty Clay	21 - 40	high
Clay	greater than 40	very high

PROPORTION

DESCRIPTIVE TERM	PERCENT OF SAMPLE WEIGHT
trace	1 - 10
little	10 - 20
some	20 - 35
and	35 - 50

The primary component is fully capitalized if >50% of sample

COLOR

Blue - blue	Gy - gray	Wh - white
Blk - black	Or - orange	Yl - yellow
Bwn - brown	Rd - red	Lgt - light
Gn - green	Tn - tan	Dk - dark

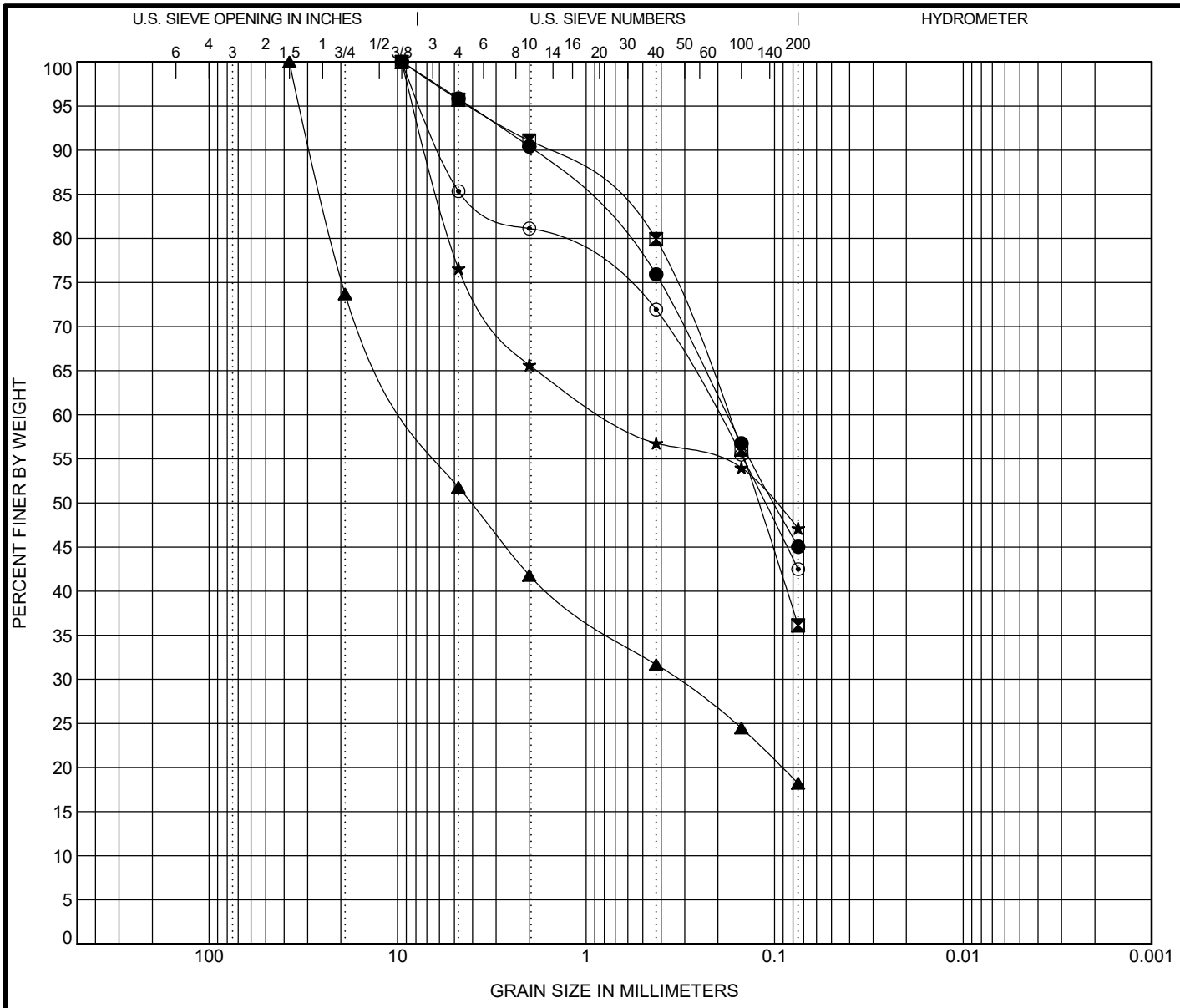
SAMPLE NOTATION

S - Split Spoon Soil Sample
U - Undisturbed Tube Sample
C - Core Sample
B - Bulk Soil Sample
NR - No Recovery of Sample

WOC - Weight of Casing
WOR - Weight of Rods
WOH - Weight of Hammer
PPR - Compressive Strength based on Pocket Penetrometer
TV - Shear Strength (tsf) based on Torvane

ADDITIONAL CLASSIFICATIONS

New York City Building Code soil classifications are given in parentheses at the end of each description of material, if applicable. See sections 1804.2 of the 2008 Building Code for further details.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	B-1	5.0	S-2	Bwn c-f SAND, and Silt, trace f Gravel	11.9					
⊠	B-1	9.0	S-4	Rd-Bwn m-f SAND, and Silt, trace f Gravel	10.9					
▲	B-2	6.0	S-3	Bwn c-f Gravel, some c-f Sand, little Silt	7.5					
★	B-3	6.0	S-4	Bwn Silt, some c-f Sand, some f Gravel	9.3					
⊙	B-4	6.0	S-4	Rd-Bwn c-f Sand, and Silt, little f Gravel	12.1					

	Sample Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	Source of Material
●	B-1	5.0	S-2	9.5	0.179			4.1	50.8	45.0		Boring
⊠	B-1	9.0	S-4	9.5	0.178			4.3	59.6	36.1		Boring
▲	B-2	6.0	S-3	37.5	7.989	0.333		48.2	33.6	18.2		Boring
★	B-3	6.0	S-4	9.5	0.748			23.4	29.5	47.1		Boring
⊙	B-4	6.0	S-4	9.5	0.2			14.6	42.9	42.5		Boring

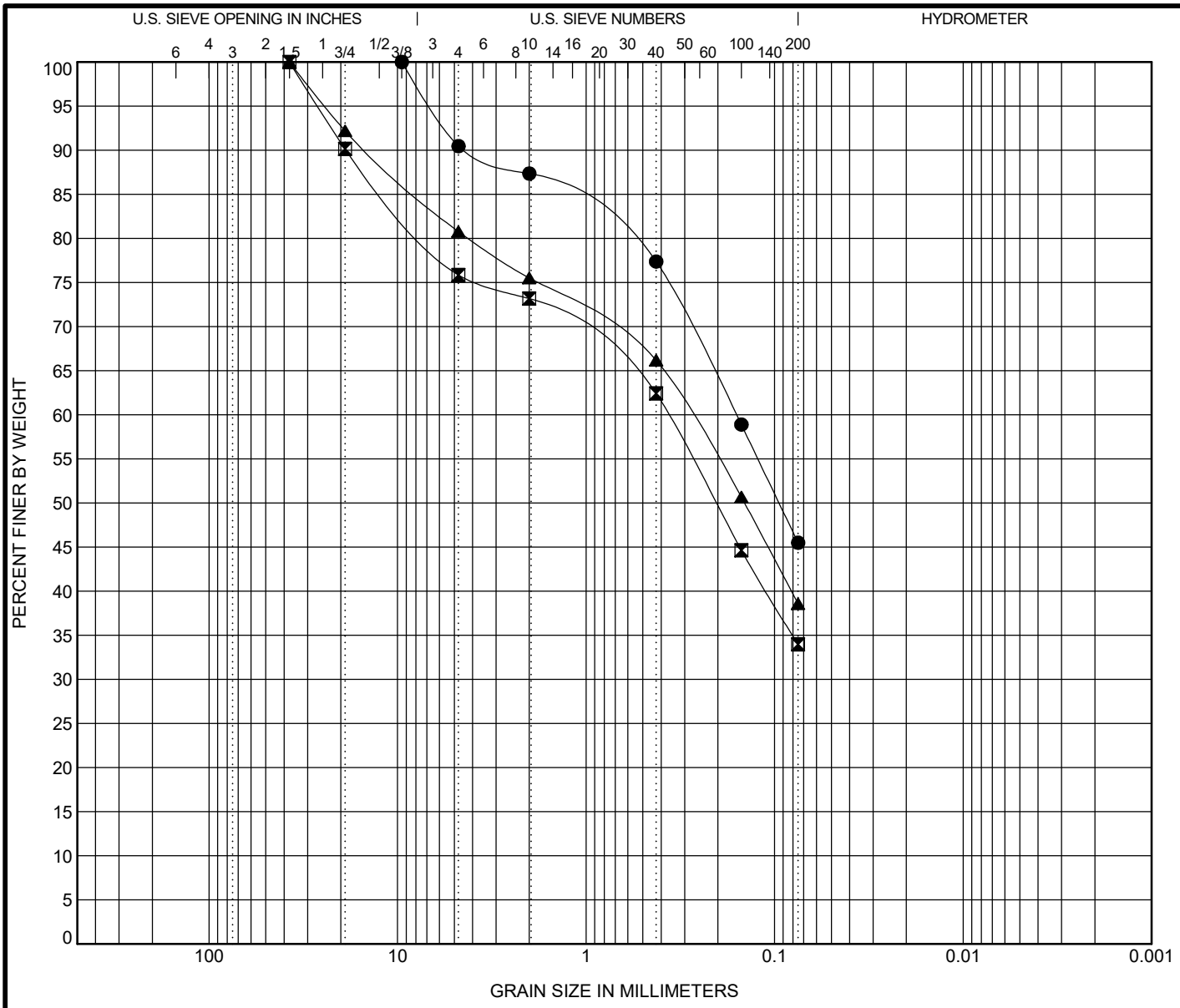
Tectonic
280 Little Britain Road, Bldg. 2
Newburgh, NY 12550
Telephone: (845) 563-9081 Fax: (845) 563-9085

GRAIN SIZE DISTRIBUTION

Project No: **12651.01** Date: **9/6/24**

Project: **Rockland BOCES**

Location: **West Nyack, NY**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	B-5	0.0	S-1	Rd-Bwn Silt, and m-f Sand, trace f Gravel	11.5					
⊠	B-6	4.0	S-3	Rd-Bwn m-f Sand, some Silt, some c-f Gravel	16.1					
▲	B-6	10.0	S-6	Bwn-Rd c-f Sand, and Silt, little c-f Gravel	14.9					

	Sample Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	Source of Material
●	B-5	0.0	S-1	9.5	0.16			9.5	45.0	45.5		Boring
⊠	B-6	4.0	S-3	37.5	0.369			24.2	41.9	34.0		Boring
▲	B-6	10.0	S-6	37.5	0.281			19.2	42.2	38.6		Boring

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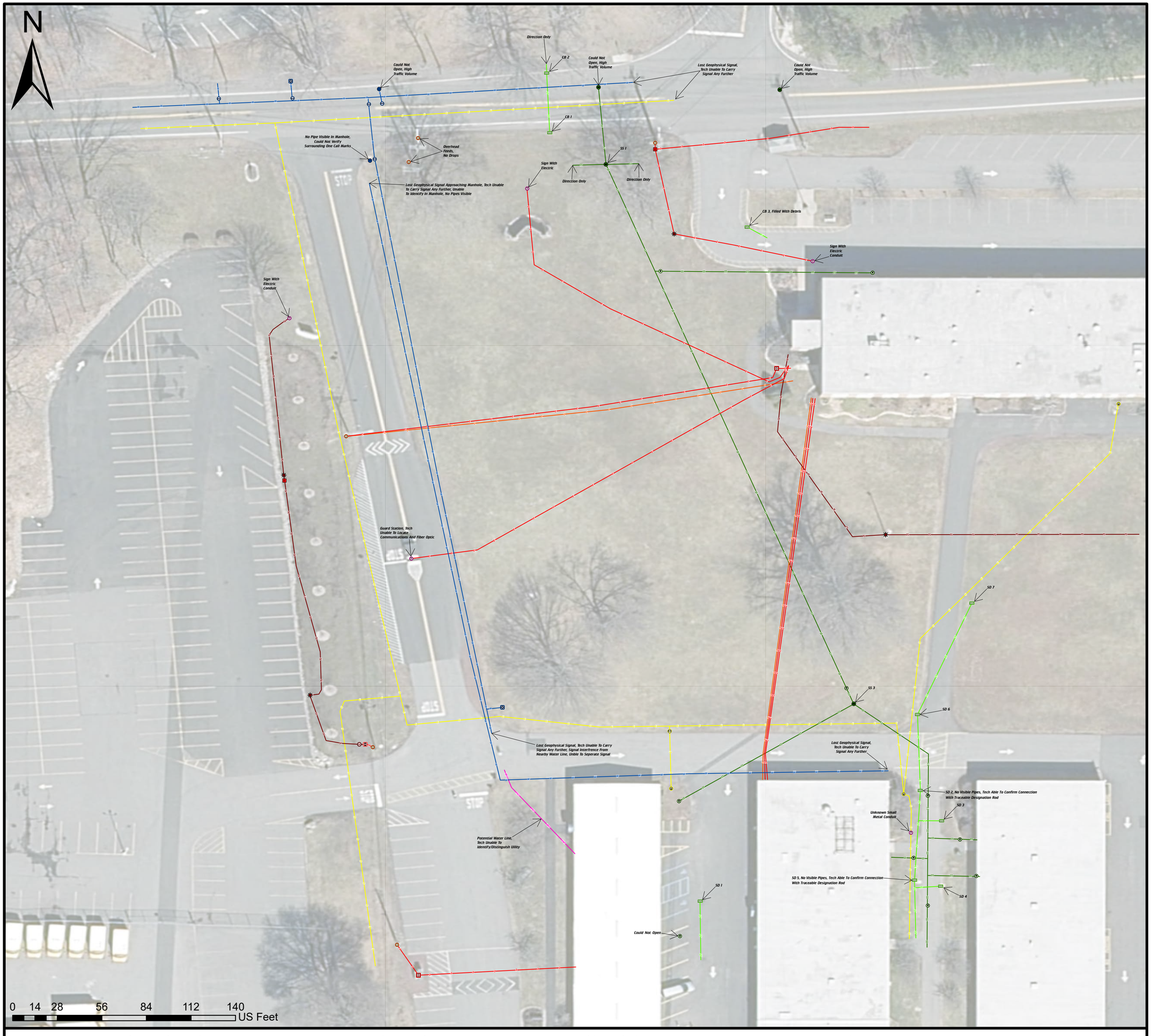
GRAIN SIZE DISTRIBUTION

Project No: **12651.01** Date: **9/6/24**

Project: **Rockland BOCES**

Location: **West Nyack, NY**

APPENDIX II



CLIENT: Tectonic Engineering **CREW:** L. Abernethy **DATE:** 7/8 - 7/10 **PROJECT NUMBER:** 143700 **PREPPED BY:** GRN **PAGE:** 1 of 1

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Utility Locating / Vacuum Excavation
Subsurface Utility Engineering / GPR Investigations
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SITE AND LOCATION

Rockland BOCES

COLOR CODE

ELECTRIC: *Electric Power Lines, Cables, Conduits, Duct Banks, and Lighting Cables*

COMM: *Telephone Lines, Fiber Optic Cables, CATV Cables, Conduits, and Duct Banks*

GAS: *Natural Gas, Propane, Petroleum, Oil, Steam, Gaseous Chemical Pipes, or Flammable Material*

WATER: *Domestic, Fire, and Potable Pipes*

SEWER / STORM: *Sanitary Sewer Lines and Drainage Systems*

DOT: *Traffic Signals, ITMS, Trip Wires, Control Cables, and Conduits*

UNKNOWN: *Unknown Anomalies and Facilities*

RECLAIMED WATER: *Chilled Water, Irrigation, and Slurry Lines*

Legend

- Water Fire Hydrant
- Water Valve
- Water Manhole
- Electric Transformer
- Electric Meter
- Electric Handbox
- Site Light Pole
- Site Light Conduit
- Utility Pole
- Storm Catch Basin
- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- Gas Valve
- Gas Meter
- Unknown Feature
- Water Line
- Electric Line
- Site Lighting Line
- Communications Line
- Storm Drain Line
- Sanitary Sewer Line
- Gas Line
- Unknown Line

CLARIFICATIONS

ALL FIELD SKETCHES ARE NOT TO SCALE...

AND ARE FOR RELATIVE LOCATION PURPOSES ONLY. SOFTDIG EXERCISES ITS BEST PROFESSIONAL EXPERTISE & GEOPHYSICAL PROSPECTING TECHNIQUES TO DESIGNATE SUBSURFACE UTILITIES. SOFTDIG DOES NOT GUARANTEE THAT UTILITIES MARKED CONSTITUTE ALL UTILITIES WITHIN THE PROJECT AREA. PRIOR TO ACTUAL CONSTRUCTION, UTILITIES MUST BE SUBSURFACE LOCATED BY SOFTDIG AT POTENTIAL CONFLICT POINTS TO AVOID PERSONAL INJURY AND/OR PROPERTY DAMAGE.

***QUALITY LEVEL B:** INFORMATION OBTAINED BY THE APPLICATION OF APPROPRIATE SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND HORIZONTAL POSITION OF UTILITIES WITHIN THE PROJECT LIMITS. ALL UTILITIES SHOWN AS QL-B EXCEPT AS NOTED.*
***QUALITY LEVEL C:** INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE ABOVE-GROUND UTILITY FEATURES AND BY USING PROFESSIONAL JUDGEMENT IN CORRELATING THIS INFORMATION TO QUALITY LEVEL D INFORMATION. UTILITIES DESIGNATED AS QL-C ARE REPRESENTED BY DASHED LINES. THESE MAY NOT HAVE CORRESPONDING FIELD MARKS. DEPTH READINGS SHOWN ARE ESTIMATIONS ONLY. THIS INFORMATION IS NOT GUARANTEED AND IS NOT TO BE USED FOR DESIGN OR BASIS FOR CONSTRUCTION. CLIENTS RELYING ON INSTRUMENT READINGS DO SO AT THEIR OWN RISK. TRUE DEPTH IS ONLY OBTAINED BY EXPOSING THE UTILITY.*
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PROVIDING UNDERGROUND UTILITY MAPPING SERVICES TO THE EASTERN UNITED STATES AND TEXAS

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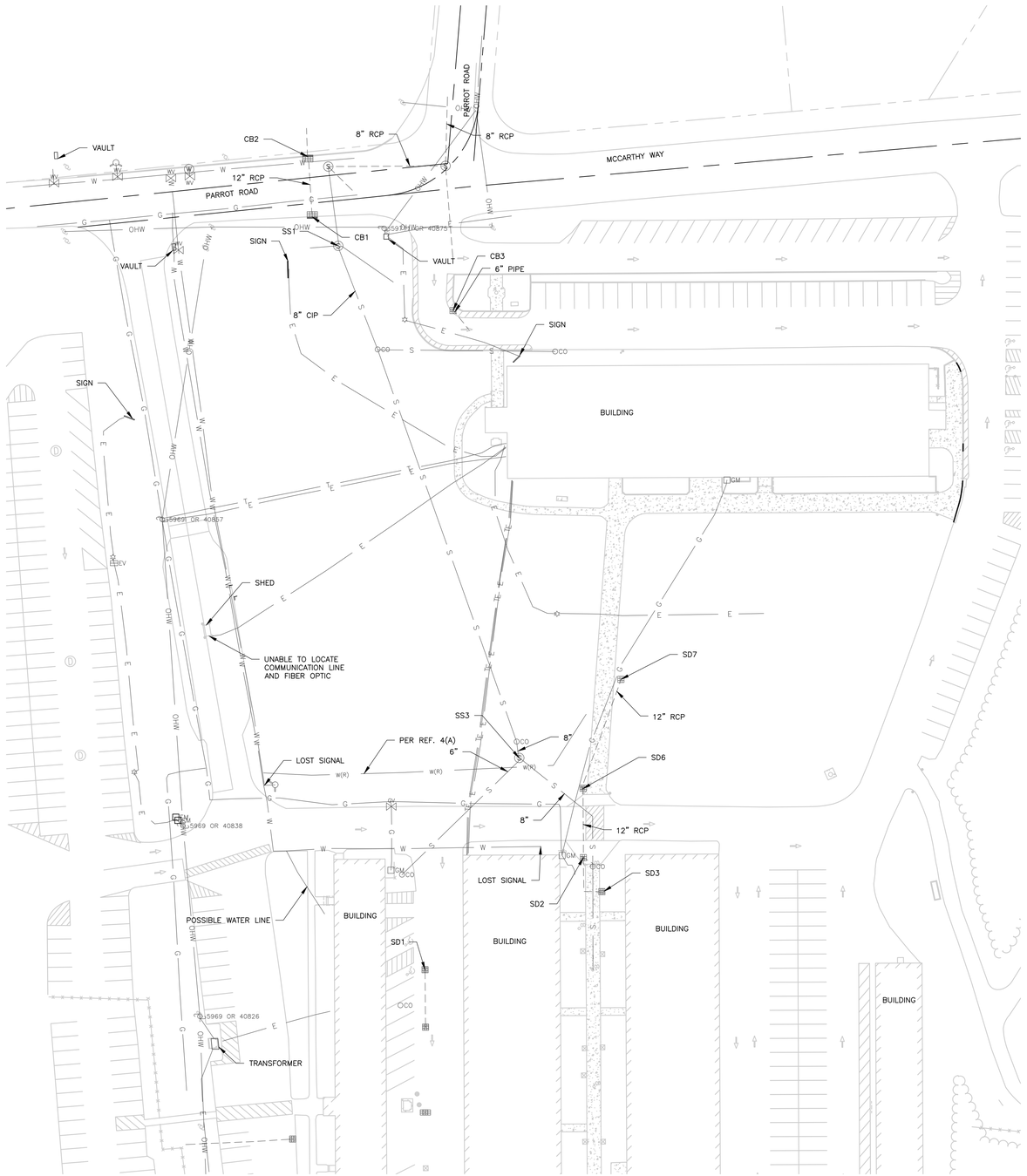
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Tectonic
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70 Pleasant Hill Road, PO Box 37
Mountainville, NY, 10953
Phone: 845-534-5959
Fax: 845-534-59993

N

PER REF. 4(A)



NOTE: ALL IMPROVEMENTS ARE BASED ON REFERENCE 4(A). TECTONIC ASSUMES NO RESPONSIBILITY FOR IMPROVEMENTS.

LEGEND

E	ELECTRIC (UNDERGROUND, PER MARKOUT)
G	GAS (UNDERGROUND, PER MARKOUT)
OHW	OVERHEAD WIRES
S	SANITARY SEWER, PER MARKOUT
	STORM SEWER, PER MARKOUT
W	WATER (UNDERGROUND, PER MARKOUT)
W(R)	WATER (RECORD, PER REF 4(A))
	STRUCTURE
	UTILITY POLE
	CATCH BASIN
	CURB INLET
	FIELD INLET (SQUARE)
S	MANHOLE (SAN. SEWER)
MH	MANHOLE (UNKNOWN)
W	MANHOLE (WATER)
GV	GAS VALVE
WV	WATER VALVE
UV	UNKNOWN VALVE
	HYDRANT
	SIGN
	LIGHT POST
EM	ELECTRIC METER
UPB	UNKNOWN PULLBOX



LOCATION MAP

SCALE: 1" = 2000'

GENERAL NOTES

1. THIS PLAN IS BASED ON A FIELD SURVEY BY TECTONIC ENGINEERING CONSULTANTS, GEOLOGISTS & LAND SURVEYORS, D.P.C. COMPLETED ON 07/16/2024.
2. MERIDIAN AND COORDINATES PER REFERENCE 4(A).
3. ANGLES OR BEARINGS SHOWN HEREON ARE FORMATTED IN DEGREES, MINUTES, AND SECONDS. DISTANCES OR ELEVATIONS SHOWN HEREON ARE IN U.S. SURVEY FEET, UNLESS NOTED OTHERWISE.
4. REFERENCES:
   (A) AUTOCAD FILE OF ROCKLAND BOCES PROVIDED BY CLIENT, DATED NONE.
5. UNDERGROUND IMPROVEMENTS IF ANY AND NOT VISIBLE AT THE TIME OF THE SURVEY, HAVE NOT BEEN LOCATED IN THE FIELD OR SHOWN HEREON.
6. LOCATIONS OF ALL UTILITIES AND SUBSTRUCTURES ARE APPROXIMATE ONLY BASED ON SURFACE EVIDENCE AND EXISTING PLANS. THE INFORMATION GIVEN ON THE SURVEY PERTAINING TO UTILITIES AND SUBSTRUCTURES IS NOT CERTIFIED TO ACCURACY OR COMPLETENESS. CONSULT WITH THE APPROPRIATE COMPANY OR AGENCY BEFORE DESIGNING OR CONSTRUCTING IMPROVEMENTS. TECTONIC ENGINEERING CONSULTANTS, GEOLOGISTS & LAND SURVEYORS, D.P.C. WILL NOT BE RESPONSIBLE FOR ANY DAMAGE SUBSEQUENTLY CAUSED TO PERSONNEL, STRUCTURES, OR UTILITIES.
7. THIS SURVEY PLAT IS FOR SITE PLAN/ENGINEERING PURPOSES ONLY AND IS NOT INTENDED TO BE USED FOR THE TRANSFER OF TITLE.
8. WETLANDS, IF PRESENT, HAVE NOT BEEN LOCATED OR SHOWN HEREON.
9. NOT ALL IMPROVEMENTS ON THE PARCEL BEING SURVEYED ARE SHOWN HEREON.
10. UTILITY MARK OUT BY SOFT DIG UNDERGROUND SERVICES INC. COMPLETED ON 07/10/2024. UTILITIES DEPICTED IN THE LEGEND LABELED (BY MARKOUT) HAVE BEEN INVESTIGATED IN ACCORDANCE WITH: SUBSURFACE UTILITY ENGINEERING INDUSTRY STANDARDS, ASCE STANDARD 38-02. USE OF SUBSURFACE UTILITY ENGINEERING (SUE) DOES NOT RELIEVE CLIENT, CONTRACTORS, PROPERTY OWNERS, UTILITY OWNERS OR GOVERNMENTAL AGENCIES OF THE RESPONSIBILITY OF NOTIFYING NEW YORK ONE CALL SYSTEM PRIOR TO STARTING EXCAVATION. TECTONIC ENGINEERING AND SOFT DIG UNDERGROUND SERVICES INC. WILL NOT BE ASSUMED OR HELD RESPONSIBLE FOR DAMAGES TO UTILITIES OR PROPERTY CAUSED BY OTHERS AND CANNOT GUARANTEE THAT ALL UTILITIES WILL HAVE BEEN LOCATED OR THAT THEIR LOCATION WILL BE ACCURATELY IDENTIFIED. SOFT DIG UNDERGROUND SERVICES INC. AND TECTONIC ARE NOT RESPONSIBLE FOR ANY UTILITIES CHANGED OR ADDED AFTER 07/10/2024.
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0 1 2 3

ORIGINAL SIZE IN INCHES

Rev	Date	Revision	Approved
0	07/29/24	ISSUED	

DRAWING CONTROL

Designed by:	Drawn by:	Checked by:
N/A	MT	TAF

Purpose	Released by	Date
○ For Comment		
○ For Approval		
○ For Bid		
○ For Construction		

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UNDERGROUND MARKOUT SURVEY

ROCKLAND BOCES
65 PARROT ROAD
TOWN OF CLARKSTOWN, HAMLET OF WEST NYACK
ROCKLAND COUNTY, NY

Date	Work Order	Drawing No.	Rev
07/29/24	12589.01	SU-101	0

Scale 1" = 40'

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.2 RELATED WORK:

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).

B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Reserved items that are to remain the property of the Owner: Section 01 00 00, GENERAL REQUIREMENTS.

E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

F. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.

G. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:

1. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
2. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Owner; any damaged items shall be repaired or replaced as approved by the Owner. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Repairs, reinforcement, or structural replacement must have Owner's approval.

G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

1.4 UTILITY SERVICES:

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION:

A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:

1. As required for installation of new utility service lines.
2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Owner's property to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Owner. Break up concrete slabs below grade that do not require removal from present

location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Owner. When Utility lines are encountered that are not indicated on the drawings, the Owner shall be notified prior to further work in that area.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Owner. Clean-up shall include off the Owner's property disposal of all items and materials not required to remain property of the Owner as well as all debris and rubbish resulting from demolition operations.

END OF SECTION 02 41 00

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE (CIVIL)

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

A. Testing agency retained and reimbursed by the Contractor and approved by Resident Engineer.

B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.

C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES:

A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).

B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.

C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).

D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.

2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS:

A. ACI SP-66 – ACI Detailing Manual.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 301 – Standard Specifications for Structural Concrete.

1.6 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Shop Drawings: Reinforcing steel: Complete shop drawings

C. Mill Test Reports:

1. Reinforcing Steel.
2. Cement.

D. Manufacturer's Certificates:

1. Abrasive aggregate.
2. Lightweight aggregate for structural concrete.
3. Air-entraining admixture.
4. Chemical admixtures, including chloride ion content.
5. Waterproof paper for curing concrete.
6. Liquid membrane-forming compounds for curing concrete.
7. Non-shrinking grout.
8. Liquid hardener.
9. Waterstops.
10. Expansion joint filler.
11. Adhesive binder.

E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.

1.7 DELIVERY, STORAGE, AND HANDLING:

A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.

B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement // and fly ash // in separate suitable bins.

C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE:

A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.

B. Agenda: Includes but is not limited to:

1. Submittals.
2. Coordination of work.
3. Availability of material.
4. Concrete mix design including admixtures.
5. Methods of placing, finishing, and curing.
6. Finish criteria required to obtain required flatness and levelness.
7. Timing of floor finish measurements.
8. Material inspection and testing.

C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.

D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.9 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117-10 ..... Tolerances for Concrete Construction and Materials

211.1-91(R2009) ..... Selecting Proportions for Normal, Heavyweight, and Mass Concrete

211.2-98(R2004) ..... Selecting Proportions for Structural Lightweight Concrete

214R-02 ..... Evaluation of Strength Test Results of Concrete

301-10 ..... Structural Concrete

304R-00(R2009) ..... Guide for Measuring, Mixing, Transporting, and Placing Concrete

305R-10 ..... Hot Weather Concreting

306R-10 ..... Cold Weather Concreting

308R-01(R2008) ..... Standard Practice for Curing Concrete

309R-05 ..... Guide for Consolidation of Concrete

318-08 ..... Building Code Requirements for Reinforced Concrete and Commentary

347-04 ..... Guide to Formwork for Concrete

SP-66-04 ..... ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):

A135.4-2004..... Basic Hardboard

D. American Society for Testing and Materials (ASTM):

A82/A82M-07 ..... Steel Wire, Plain, for Concrete Reinforcement

A185/185M-07..... Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

A615/A615M-09 ..... Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A653/A653M-09 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

A706/A706M-09 ..... Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

A767/A767M-09 ..... Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-07 ..... Epoxy-Coated Reinforcing Steel Bars

A820-06..... Steel Fibers for Fiber-Reinforced Concrete

A996/A996M-09 ..... Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

C31/C31M-09..... Making and Curing Concrete Test Specimens in the field

C33-08..... Concrete Aggregates

C39/C39M-09..... Compressive Strength of Cylindrical Concrete Specimens

C94/C94M-09..... Ready-Mixed Concrete

C143/C143M-10..... Slump of Hydraulic Cement Concrete

C150-09 ..... Portland Cement

C171-07 ..... Sheet Materials for Curing Concrete

C172-08 ..... Sampling Freshly Mixed Concrete

C173-10... ..... Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M-07..... Making and Curing Concrete Test Specimens in the Laboratory

C231-09 ..... Air Content of Freshly Mixed Concrete by the Pressure Method

C260-06 ..... Air-Entraining Admixtures for Concrete

C309-07 ..... Liquid Membrane-Forming Compounds for Curing Concrete

C330-09 ..... Lightweight Aggregates for Structural Concrete

C494/C494M-10 ..... Chemical Admixtures for Concrete

C618-08 ..... Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

C666/C666M-03 ..... Resistance of Concrete to Rapid Freezing and Thawing

C881/C881M-02 ..... Epoxy-Resin-Base Bonding Systems for Concrete

C1107/1107M-08 ..... Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

C1315-08 ..... Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

D6-95(R2006) ..... Loss on Heating of Oil and Asphaltic Compounds

D297-93(R2006) ..... Rubber Products-Chemical Analysis

D1751-04(R2008) ..... Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D4397-09 ..... Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

E1155-96(R2008) ..... Determining F_F Floor Flatness and F_L Floor Levelness Numbers

E. American Welding Society (AWS):

D1.4/D1.4M-11 ..... Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):

Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):

Report On ..... Concrete Sealers for the Protection of Bridge Structures

H. U. S. Department of Commerce Product Standard (PS):

PS 1 ..... Construction and Industrial Plywood

PS 20 ..... American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513 ..... Rubber Waterstops

CRD C572 ..... Polyvinyl Chloride Waterstops

PART 2 – PRODUCTS:

2.1 FORMS:

A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.

B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.

C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.

D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.

E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.

F. Form Lining:

1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS:

A. Portland Cement: ASTM C150 Type I or II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.

C. Coarse Aggregate: ASTM C33.

1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify

that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.

F. Mixing Water: Fresh, clean, and potable.

G. Admixtures:

1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Air Entraining Admixture: ASTM C260.
6. Microsilica: Use only with prior review and acceptance of the Resident Engineer. Use only in conjunction with high range water reducer.
7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

H. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Reinforcing Bars to be Welded: ASTM A706.

L. Galvanized Reinforcing Bars: ASTM A767.

M. Epoxy Coated Reinforcing Bars: ASTM A775.

N. Cold Drawn Steel Wire: ASTM A82.

O. Reinforcement for Concrete Fireproofing: 100 mm x 100 mm x 3.4 mm diameter (4 x 4-W1.4 x W1.4) welded wire fabric, secured in place to hold mesh 20 mm (3/4 inch) away from steel. Mesh at steel columns shall be wired to No. 10 (No. 3) vertical corner steel bars. //

P. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m^2 (1.5 pounds per square yard), or square mesh at .6Kg/m^2 (1.17 pounds per square yard).

Q. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

R. Expansion Joint Filler: ASTM D1751.

S. Sheet Materials for Curing Concrete: ASTM C171.

T. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

U. Abrasive Aggregate: Aluminum oxide grains or emery grits.

V. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.

W. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous siliconate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .

1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.
2. MVE 15-Year Warranty:
   a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

X. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.

Y. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

Z. Adhesive Binder: ASTM C881.

1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Water Stop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
4. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

5. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m^3 (1.5 lb. per cubic yard). Product shall have a UL rating.
6. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m^3 (30 lb. per cubic yard).
7. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
8. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
9. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

2.3 CONCRETE MIXES:

A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.

1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, // fly ash, // admixtures, weight of fine and coarse aggregate per m^3 (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement // -fly ash // ratio, and consistency of each cylinder in terms of slump. // include dry unit weight of lightweight structural concrete.//
3. Prepare a curve showing relationship between water-cement // -fly ash// ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
4. If the field experience method is used, submit complete standard deviation analysis.

B. Fly Ash Testing: Submit certificate verifying conformance with specifications initially with mix design and for each truck load of fly ash delivered from source. Notify Resident Engineer immediately when change in source is anticipated. Prior to beginning trial mixes submit to the Resident Engineer the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.

1. Fly ash - 2.25 kg (five pounds).
2. Portland cement - 3.5 kg (8 pounds):
   a. Address -Waterways Experiment Station (WES)
   b. 3909 Halls Ferry Road
   c. Vicksburg, MS 39180-6199
   d. ATTN: Engineering Materials Group

C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement // and fly ash //, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement // and fly ash // and approval of design mix.

D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio
35 (5000)[1,3]	375 (630)	0.45	385 (650)	0.40
30 (4000)[1,3]	325 (550)	0.55	340 (570)	0.50
25 (3000)[1,3]	280 (470)	0.65	290 (490)	0.55
25 (3000)[1,2]	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES)*

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm

(3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

TABLE III - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

I. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C $\pm$ 1.7 degrees C (73.4 $\pm$ 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.

J. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

K. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.

L. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than

specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

2.4 BATCHING AND MIXING:

A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Resident Engineer. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38^0C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Resident Engineer.

PART 3 – EXECUTION

3.1 FORMWORK:

A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.

1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
2. Provide forms for concrete footings unless Resident Engineer determines forms are not necessary.
3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.

B. Treating and Wetting: Treat or wet contact forms as follows:

1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
3. Use sealer on reused plywood forms as specified for new material.

C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than 1/270 of free span of member.

D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.

E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.

1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by Resident Engineer. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Resident Engineer, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT:

A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.

B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.

1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. // Use epoxy-coated tie wire with epoxy-coated reinforcing. // Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.

C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.

D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:

1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
    a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
    b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
    c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
    a. Initial qualification: In the presence of Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
    b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.

E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Resident Engineer.

F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.

G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER:

A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.

1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
3. Patch punctures and tears.

3.4 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:

A. Sealer is applied on the day of the concrete pour or as as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays.

B. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.

1. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
2. Spray apply Sealer at the rate of 20 m^2 (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
3. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

3.5 CONSTRUCTION JOINTS:

A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.

B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal. //

3.6 EXPANSION JOINTS:

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal. //

3.7 PLACING CONCRETE:

A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.

2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

1. Preparing surface for applied topping:
   a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
   b. Broom clean and keep base slab wet for at least four hours before topping is applied.
   c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.

1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
7. Concrete on metal deck:
   a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
      1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.

2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER:

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.9 COLD WEATHER:

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.10 PROTECTION AND CURING:

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Resident Engineer.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage $10m^2/L$ (400 square feet per gallon) on steel troweled surfaces and $7.5m^2/L$ (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.

3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS:

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. For post-tensioned systems supporting forms and shoring not removed until stressing is completed. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

3.12 CONCRETE SURFACE PREPARATION:

A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.

B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.13 CONCRETE FINISHES:

A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Resident Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
    a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
    b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 µm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
    c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
    d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m^2 (2 square feet) in each 93 m^2 (1000 square feet) of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to Resident Engineer and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Resident Engineer determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.

4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Resident Engineer from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    a. Areas covered with carpeting, or not specified otherwise in b. below:
        1) Slab on Grade:
            a) Specified overall value — F_F 25/F_L 20
            b) Minimum local value — F_F 17/F_L 15
        2) Level suspended slabs (shored until after testing) and topping slabs:
            a) Specified overall value — FF 25/FL 20
            b) Minimum local value — FF 17/FL 15
        3) Unshored suspended slabs:
            a) Specified overall value — FF 25
            b) Minimum local value — FF 17
        4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
    b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
        1) Slab on grade:
            a) Specified overall value — FF 36/FL 20
            b) Minimum local value — FF 24/FL 15

2) Level suspended slabs (shored until after testing) and topping slabs
   a) Specified overall value FF 30/FL 20
   b) Minimum local value FF 24/FL 15
3) Unshored suspended slabs:
   a) Specified overall value FF 30
   b) Minimum local value FF 24
4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements
    a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Resident Engineer, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
    b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
13. Acceptance/ Rejection:
    a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
    b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by Resident Engineer, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.

B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m^2 (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING:

A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.

B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 RESURFACING FLOORS:

Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

3.17 RETAINING WALLS:

A. Use air-entrained concrete.

B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.

C. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.

D. Place porous backfill as shown.

3.18 PRECAST CONCRETE ITEMS:

Precast concrete items, not specified elsewhere. Cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish to match corresponding adjacent concrete surfaces. Reinforce with steel for safe handling and erection.

END OF SECTION 03 30 00

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SECTION 03 30 00 – CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SCOPE

A. Provide all materials, labor and appliances to perform work of this Section, including but not limited to the following:

1. Footings, pile caps, foundation walls, grade beams, and slabs on grade.
2. Concrete framing including columns, walls, beams, and slabs.
3. Concrete stairs, ramps, platforms, etc., both interior and exterior.
4. Concrete topping and fill on metal deck.
5. Concrete retaining walls.
6. Formwork for concrete.
7. Reinforcement for concrete.
8. Vapor barriers, water stops, joint fillers, and sliding bearings.
9. Abrasive finishes and other surface finishes.
10. Install inserts, sleeves, slots, anchors, reglets, dovetail anchor slots, openings in floor and walls, etc. as required and provided by other trades. Cooperate fully with trades installing sleeves and conduit in concrete work. See that these items are properly placed in the forms before casting any concrete and take care that they are not damaged or displaced while casting concrete.
11. Set and/or grout devices furnished by trades under other sections of this specification for embedment into the concrete, anchorage into concrete, and/or bearing on concrete work, i.e. anchor bolts for columns.
12. The setting of anchorage devices into forms shall be accurately done by line and transit. Locate anchorage devices and anchor bolts as shown on the drawings and as shown on approved shop drawings of the trade affected, according to directions of the trade affected and adequately secured in the forms.
13. Provide and install pre-molded joint filler and water stops.
14. Fill pipe slots and sleeves with a grout mixture of 1 part cement to 3 parts sand by volume after pipes are in place and finish the surfaces level with the surrounding concrete.
15. Where framed slabs or slabs on grade are exposed to the elements temporarily before roofing can be installed and permanent heat provided, Contractor shall be fully responsible for protecting the slabs from damage due to frost weathering, the leakage of water through the slabs, and excessive wear. Provide polyethylene enclosures and/or covering and temporary heat or take other protective measures to protect the slabs and to protect stored materials or finishes below the slab from damage.
16. Do not place conduits, junction boxes, or any other item made of aluminum into concrete. Aluminum items shall in no case be placed in direct contact with concrete or cement work.
17. Provide lightweight concrete fill where shown on drawings and where required to bring finished floor to required elevations, whether shown on drawings or not, at no additional cost.
18. Include concrete work required for other trades, concrete pads for equipment, concrete lined trenches, and all other concrete not covered by other sections, but as required to complete the work.
19. Architectural Concrete where designated on the Architectural and/or Structural drawings, or as defined herein.

1.2 GENERAL PROVISIONS

A. Standard Specifications and Codes issued by professional organizations and governmental agencies are specified hereinafter by basic designations and only the applicable editions and revisions thereto shall apply to the work of this Section.

B. Applicable Codes, Specifications, and Guides as listed below, but not limited to:

1. The 2020 Building Code of New York State.
2. Building Code Requirements for Structural Concrete (ACI 318).
3. Specification for Tolerances for Concrete Construction and Materials (ACI 117).
4. Specifications for Structural Concrete (ACI 301).
5. Standard Specification for Cast-in-Place Architectural Concrete (ACI 303.1).
6. Specification for Hot Weather Concreting (ACI 305.1).
7. Standard Specification for Cold Weather Concreting (ACI 306.1).
8. Specification for Curing Concrete (ACI 308.1).
9. Structural Welding Code – Reinforcing Steel (AWS D1.4/D1.4M).
10. Standard Specification for Ready-Mixed Concrete (ASTM C94/C94M).
11. Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete (ASTM C311).
12. Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete (ASTM C618).
13. Standard Specification for Slag Cement for Use in Concrete and Mortars (ASTM C989).

C. In case of any conflict between the referenced standards and these specifications, the one having more stringent requirements shall prevail.

D. Coordination - Carry out the work of this Section in coordination and cooperation with contiguous work of other trades and/or Contracts involved.

E. Furnish all tests, reports, and affidavits required by the Department of Buildings.

F. Testing and Special Inspections:

1. The licensed testing and inspection laboratory/agency (Laboratory) acceptable to the Building Department and to the Structural Engineer of Record will be hired and paid directly by the Owner. Alternatively, at Owner’s discretion, the Structural Engineer of Record, if qualified, shall be hired to perform the special inspection services and act as Laboratory.
2. The Laboratory will submit reports to the Architect. The Laboratory will provide special inspections of concrete in the field and will test specimens taken from concrete as cast at the site. The Laboratory will employ only qualified inspectors to perform all special inspections and laboratory tests. The testing and inspection by the Owner's Laboratory in no way relieves the Contractor of responsibility for the required quality.
3. Inspection and testing in the field by the Laboratory: The Laboratory will provide the following services:

    a. Have a qualified Special Inspector on site at all times when concrete is being placed. All inspections shall be done by or under the supervision of a licensed Structural Engineer.
    b. Make, transport, cure, and test 6 inch diameter by 12 inch test specimens taken from concrete being cast. 4 inch diameter by 8 inch test specimens may be used with prior approval of the Structural Engineer of Record. If 4 inch diameter specimens are used, the number of cylinders taken per test shall increase as required by the building code.

c. Provide Continuous Special Inspections as follows:

1) Each time fresh concrete is sampled to make specimens for strength tests perform slump, air and water content tests, and determine the temperature of concrete and unit weight as described below:

a) Slump (ASTM C143): One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
b) Air Content (ASTM C231: pressure method, for normal-weight concrete; ASTM C173: volumetric method, for structural lightweight concrete): One test for each composite sample, but not less than one test for each day's pour of each concrete mix.
c) Concrete Temperature (ASTM C1064): One test hourly when air temperature is 40°F and below and when 80°F and above, and one test for each composite sample.
d) Unit Weight (ASTM C138 for normal-weight concrete; ASTM C567 for structural lightweight concrete): One test for each composite sample, but not less than one test for each day's pour of each concrete mix.

2) Inspect concrete for proper application techniques; review timely delivery of concrete to the site, check the quality of concrete, check the proper handling, chuting, vibration, lag between placement, cleaning of forms and concrete surfaces and any other workmanship applicable thereto.
3) Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased.

d. Provide Periodic Special Inspections as follows:

1) Inspect the placing, size, and quality of reinforcement based on the shop drawings approved by the Structural Engineer of Record. Only approved shop drawings shall be used to perform Special Inspections. Inspection performed based on unapproved drawings shall be considered not valid.
2) Verify use of specified design mix.
3) Check maintenance of specified curing temperature and techniques.
4) Verify strength of concrete prior to removal of shores and forms from beams and structural slabs.
5) Check formwork for shape, location, and dimensions of the formed member.

4. Minimum number and frequency of cylinder tests:

a. Test cylinders for each class of concrete placed each day will be taken in accordance with ASTM C172 and molded and laboratory-cured in accordance with ASTM C31. If required by the Department of Buildings, strength tests of cylinders cured under field conditions shall be provided. The contractor shall provide the specified field storage and monitor the temperature as per ASTM C31. The cylinders shall be taken at the rate of 3 cylinders minimum (6”x12”) for each 100 cubic yards of each class of concrete plus 3 cylinders for each 50 cubic yards or less in excess of the even 100 cubic yards cast. Take at least 3 cylinders of each class, however, for any one day's casting and at least 3 cylinders for each 5,000 square feet of surface area for slabs or walls. Additional cylinders are required if 4 inch diameter test specimens are chosen by the Contractor and approved for use by the Engineer.

b. If the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
c. Small volume: when the total volume of a given class of concrete is less than 50 cubic yards, strength tests are not required when evidence of satisfactory strength is submitted to and approved by the building official.

5. Additional requirements regarding cylinder testing shall be as follows:

a. Newly made cylinders for strength acceptance shall be handled carefully to avoid cracking the green concrete. Store these cylinders in a curing box at a temperature between 60 to 80 °F during the first 24 hours, or at a temperature between 68 to 78 °F for concrete with a specified strength of 6,000 psi or greater. Contractor shall construct a suitable box and provide heat if necessary to maintain cylinders at proper temperatures.
b. Place cylinders in laboratory storage, with molds removed, under moist curing conditions and at a temperature between 70 to 76 °F within 48 hours after casting. Maintain these moist curing conditions until specimens are tested.
c. Avoid jarring or damaging cylinders in transport.
d. Cylinders must be properly capped before testing, as per ASTM C31.
e. Test cylinders (at the Contractor's option and expense) to establish strength of concrete for purposes of reshoring or form removal timing shall be stored and cured in the same manner and location as the concrete for framing.
f. Additional test cylinders may be taken at the Contractor’s option and expense for the purpose of establishing strength at 56 days. A minimum of two additional cylinders is required for acceptance.

6. The Laboratory will perform concrete tests as follows:

a. Of the 3 cylinders taken for each test sampling, test 1 at 7 days for information and 2 at 28 days for acceptance. Test cylinders in accordance with ASTM C39.
b. When high early strength concrete is used, Type I cement plus non-cholorine non-corrosive accelerator or Type III cement, replace the 7-day tests with 3-day tests.
c. When 56-day strength is used in the design for concrete utilizing pozzolans in the mix, of the 5 cylinders taken test 1 cylinder at 7 days, 2 cylinders at 28 days, and 2 cylinders at 56 days**.**

7. Special Inspection reports:

a. The Special Inspection Agency shall transmit inspection reports to the Architect no later than 5 business days from the date of inspection. The reports will cover location of concrete pour, work progress, weather conditions, variations and deficiencies in quality of contractor’s work, changes in dimensions and quantities, errors and corrective methods administered in the field, etc.
b. Non-compliant inspection reports: All inspection reports indicating non-compliance shall be sent immediately to all parties on the test report distribution list under a separate title.

8. Laboratory test reports:

a. The Laboratory will transmit test reports to the Architect no later than 2 business days from the date of the test. These reports shall record the following:

1) The building unit being cast.
2) The specific location of the concrete being tested including which floor, location in the floor, columns by number, etc.
3) The specified classification, plastic weight, admixtures, age, compressive strengths, slump, air content, water content, and type of cylinder break of concrete being tested.
4) The minimum and average daily air temperature.
5) Volume of concrete represented by test.

b. All test reports shall be signed and sealed by a Professional Engineer licensed in the state of New York.
c. Non-compliant test reports: All test reports indicating non-compliance shall be sent immediately to all parties on the test report distribution list under a separate title.
d. 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.
e. 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 C42 or by other methods as directed by Architect.

9. If the Contractor elects to use concrete from more than one source of supply so that more than one batching plant inspector is required, the Contractor shall bear the costs of the additional inspectors required.
10. Facilitate the work of, and cooperate with, the Laboratory at all times and supply all concrete required for test cylinders as described above and for slump, segregation, and other field tests which the Architect may deem necessary.
11. If the strength of test cylinders at 7 days of age is less than 65% of the required 28-day strength (unless a lower percent of required strength is established to be satisfactory), the Architect may order reshoring and additional moist curing of the construction in question and may exercise reasonable prudence by ordering changes in the mix at the Contractor's expense to assure concrete of specified quality.
12. In the event that the laboratory tests taken from any part of the structure indicate that concrete does not meet the specified strength requirements, the Architect may at his discretion order tests in accordance with ASTM C42, additional curing, load tests and other tests to be made on the portion of the structure affected to determine the adequacy of such portion to sustain the loads for which it was designed. These tests shall be made at Contractor's expense. Load tests, if required, shall comply with the requirements of ACI 318. Any construction which is found deficient shall, as required by the Architect, be repaired or removed from the premises and replaced, all at the Contractor's expense. The Contractor shall bear the costs incurred by the Architect and Structural Engineer of Record at the rate of 3.6 times payroll for calculations, drawings and any other professional services required to investigate, test, inspect and correct construction, which contains concrete questionable in strength as per ACI 318. The Contractor shall also pay all additional inspection and testing costs incurred by the Owner's Laboratory resulting from investigating, testing and correcting the questionable construction.
13. Concrete shall be considered to have acceptable strength if the 28-day test cylinder strengths meet or exceed the following requirements:

a. Two cylinders of concrete at a given age shall constitute a strength test. The average of any 3 consecutive strength tests of the laboratory-cured specimens representing

each class of concrete shall equal or exceed the specified 28-day compressive strength.

b. No single test (average of 2 cylinders) shall be more than 500 psi below f_c' when f_c' is 5,000 psi or less, or by more than 0.10 f_c' when f_c' is more than 5,000 psi.

14. If any cylinder results show strengths less than the above mentioned, the concrete represented by these tests will be rejected as not meeting strength requirements.

1.3 SUBMITTALS

A. General: Submit shop drawings and other submittals for the Architect's approval in accordance with the provisions of the project General Conditions, as well as the drawings and specifications, including Section 01 33 00 – Submittal Procedures.

1. The Contractor shall be responsible for identifying, preparing and delivering all submittals required by the contract documents in a timely manner. All submittals shall be delivered gradually so as to avoid submission of large number of shop drawings and other documents not allowing the Architect's and Engineer's timely review.
2. The Contractor shall demonstrate competency in preparing and delivering the required submittals and shall recognize the appropriate time and sequence related to the process of preparation, submission, and review of submittals.
3. The Contractor shall furnish the Architect and the Engineer a Schedule of Submittals indicating the respective dates of submission of each of them, and expected date of fabrication and installation. Such schedule shall indicate submittals critical to the construction progress schedule. The Architect and the Engineer shall review the Schedule of Submittals and coordinate with the Contractor. Mutually agreed on schedule shall serve as a guideline to the Contractor's submittals. In case of substantial deviations from the schedule, the Engineer shall not be expected to review more than two (2) shop drawings in any one business day.
4. The submittal review time shall be understood as beginning on the first business day following the receipt of the submittals by the Engineer and ending on the day when the submittals have been returned to the Contractor by the Architect. Every effort shall be made by the Engineer to review the submittals so that the review time for any single document does not exceed 14 calendar days. However, the Engineer shall not be required to review any submitted document in less than 5 business days. If more expeditious review is requested and agreed to by the Engineer, the Engineer's costs associated with such expedited review of any submittal shall be withheld from the monies due the Contractor by the Owner and paid to the Engineer.

B. Materials and Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

C. Mix Designs: Submit written reports of proposed concrete mixes as per Section 3.6 of these specifications.

D. Shop Drawings: Prepare shop drawings showing reinforcement properly positioned in concrete work so that bars can be properly cut, bent, and placed from information shown on shop drawings.

1. Provide schedules and details showing placement, bending, and length of reinforcement.
2. Show elevations of concrete walls with top and bottom levels, openings, ledges, and beam pockets.

3. Show top and bottom flat slab reinforcement on separate plans.
4. Show dowels for work into which the dowels are first placed.
5. Detail “opposite hand” reinforcement separately.
6. Do not proceed with fabrication or installation until respective shop drawings marked “No Exception Taken” or “Exceptions Noted” by the Engineer have been returned to the Contractor.
7. Electronic submission of shop drawings: Shop drawings submitted electronically shall follow proper channels of submission as established with the Owner and the design team. In addition, the provisions of the General Conditions, as well as the drawings and specifications, shall be followed as established for hard copy submissions.

    a. Shop drawings shall be submitted under a separate cover, including the title block and clear identification of the project on each drawing. Provide all other pertinent information and include the Contractor’s review comments and review status on the electronic submission.
    b. Shop drawings submitted electronically shall be prepared in a standard format agreed to in advance by the Architect. All submittals must be capable of being scanned electronically for filing on a computer.
    c. Reviewed submittals shall be returned in PDF electronic format for the Contractor’s printing and distribution.

E. Cold Weather Protection: The Contractor shall submit for review a placement procedure outlining the proposed methods of protection for foundations and superstructure. This submittal shall include the temperature range at which each method will be used in addition to the intended duration of protection. If the Contractor chooses to incorporate an accelerating admixture into the concrete mix, a letter from the admixture manufacturer stating compatibility as well as a dosage chart shall be submitted with the protection plan.

1.4 MEASUREMENTS AND TOLERANCES

A. It shall be the Contractor’s sole responsibility to maintain all required dimensional tolerances, whether prescribed below or required otherwise.

B. Measurements: Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.

1. Obtain all field measurements required for proper detailing, fabrication, and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when applicable, of discrepancies and proposed solutions to correct discrepancies.

C. Tolerances for slab finishes: Refer to Part 3 of this specification for requirements.

D. Tolerances for formed surfaces: Unless otherwise specified or noted on the drawings, conform to the requirements given below or as given in ACI 117, whichever is more stringent. All tolerances shall apply to the full height of the building. Variations from grade shall be measured prior to removal of formwork.

1. Variation from plumb:

    a. In the lines and surfaces of columns, piers, walls, corners, and the like:

1) In any 10 ft. of length: 1/4 in.
2) Maximum for the entire building height: 1 in.

b. For exposed corner columns, control joint grooves, and other conspicuous lines:

1) In any 20 ft. of length: 1/4 in.
2) Maximum for the entire building height: 1/2 in.

2. Alignment:

a. At slab and/or beams, alignment of columns or walls above and below:

1) Maximum offset: 1/4 in.

3. Variation from level or specified grades and elevations:

a. In slabs, beams, girder soffits, and the like:

1) In any 10 ft. of length: 3/16 in.
2) In any bay or in any 20 ft. of length: 3/8 in.
3) Maximum for the entire length: 1/2 in.

b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

1) In any bay or in 20 ft. of length: 1/4 in.
2) Maximum for the entire length: 1/2 in.

4. Variation of building lines from theoretical positions in plan and related positions of columns, walls, piers, and the like:

a. In any bay: 1/4 in.
b. In any 20 ft. of length: 1/4 in.
c. Maximum for the entire length: 1/2 in.

5. Sleeves, wall openings, and floor openings:

a. Variation in size: 1/4 in.
b. Variation in location: 1/2 in.

6. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls:

a. Minus: 1/4 in.
b. Plus: 1/2 in.

7. Variation in the location of anchors and inserts shown in accepted shop drawings, unless more stringent tolerances are required for work of other Sections.

a. Vertically: 3/8 in.
b. Horizontally: 1/4 in.

8. Faces of formed slab edges, turned down spandrels, and parapets shall not deviate from theoretical position or alignment by more than the distance in consideration divided by 500 or by 1/2 inch, whichever is less.

9. Footings:

    a. Variations in dimensions in plan:

        1) Minus: 1/2 in.
        2) Plus: 2 in.

    b. Misplacement or eccentricity:

        1) 2% of the footing width in the direction of misplacement but not more than 2 in.

    c. Thickness:

        1) Decrease in specified thickness: 5%
        2) Increase in specified thickness: No limit

    d. Elevation at steel bearing plates:

        1) Plus: 1/4 in.
        2) Minus: 1/4 in.

10. Variation in stair dimensions:

    a. In a flight of stairs:

        1) Rise: 1/8 in.
        2) Run: 1/4 in.

    b. In consecutive steps:

        1) Riser: 1/16 in.
        2) Tread: 1/8 in.

E. Fabricating and placing tolerances for reinforcement: Bars used for concrete reinforcement shall be fabricated in accordance with the fabricating tolerances given in ACI 315 and placed in accordance with tolerances given in ACI 318 Chapter 7, or provided herein, whichever is more stringent.

1. Bars shall be placed to the following tolerances:

    a. Clear distance to formed surfaces: ±1/4 in.
    b. Minimum spacing between bars: -1/4 in.
    c. Top bars in slabs and beams:

        1) Members 8 in. deep or less: ±1/4 in.
        2) Members more than 8 in. but not over 2 feet deep: ±1/2 in.

    d. Crosswise of members: spaced evenly within 2 in.
    e. Lengthwise of members: ±2 in.

2. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to acceptance by the Engineer.

1.5 PRE-CONCRETE CONFERENCE

A. At least 30 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the specified concrete construction. The Contractor shall send a pre-concrete conference agenda to all attendees 10 days prior to the scheduled date of the conference.

B. The Contractor shall require responsible representatives of every party that is concerned with the concrete work to attend the conference, including but not limited to, the following: Contractor's superintendent who will be involved full time with the project, Developer or Building Owner, Architect, Structural Engineer, Laboratory responsible for the concrete design mix, Laboratory responsible for field quality control, concrete subcontractor, admixture supplier(s), and ready-mix concrete producer.

C. Minutes of the meeting shall be recorded by the Contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for informational purposes: Owner's representative, Architect, and Structural Engineer of Record.

D. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing, finishing, and curing procedures can produce the concrete quality required by these specifications.

E. The Structural Engineer of Record will be present at the conference. The Contractor shall notify the Engineer at least 10 business days prior to the scheduled date of the conference.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: The specifications of the American Society for Testing and Materials (ASTM), latest edition, shall apply to any and all for which an ASTM Standard has been established, unless otherwise specified below. The manufacturer or supplier of each material shall certify that his material conforms to the applicable ASTM specification.

B. Cement: Portland Cement, Type I, II or III, of approved manufacturer meeting requirement of ASTM C150, or Type LH or GU meeting requirements of ASTM C1157, except as modified below. Do not use Type III cement for concrete 2.5 feet thick or thicker.

C. Concrete aggregates:

1. Fine and coarse aggregates for normal weight concrete shall conform to ASTM C33. Aggregates shall have hard, angular, uncoated durable particles and shall be free of injurious amounts of thick elongated pieces, mica, clay, silt, and organic matter.

    a. Fine aggregate shall be natural sand or stone screenings.
    b. Coarse aggregate shall be crushed stone or gravel, meeting gradation requirements for size No. 67 (3/4 inch to No. 4) generally, except as otherwise specified herein. Size No. 467 (1-1/2 inch to No. 4) may be used in concrete for footings, mats, pile caps, and piers.
    c. Combined aggregate gradation for slabs and other designated concrete shall be 8%-18% for large top size aggregates (1-1/2 inch) or 8%-22% for smaller top size aggregates (1 inch or 3/4 inch) retained on each sieve below the top size and above the No. 100.

d. For concrete encasement of structural steel use aggregate size No. 7 (1/2 inch to No. 4).
e. Aggregates for the work will be acceptable on proof that their potential alkali reactivity is not deleterious to the concrete.

2. Coarse aggregate for structural lightweight concrete shall be an approved, uniformly graded, expanded shale of 3/4 inch maximum size, conforming to ASTM C330, and must be free of impurities that will damage finishes or cause aggregate to separate at the surface of the concrete. Handle, store, and pre-dampen lightweight aggregate as per manufacturer's recommendations before it is mixed with cement.
3. Fine aggregate shall be natural sand or stone screenings, and shall conform to ASTM C33.
4. Use especially sound, durable aggregate for all concrete exposed to the weather in the completed project. Prior to construction, obtain service records and test data, at the Contractor's expense, in writing for this aggregate and submit to the Architect. Test data shall comply with ASTM C33 for aggregates for concrete, which will be subject to wetting or extended exposure, and shall include the following:

   a. Deleterious substances including tests for material that could react harmfully with alkalis in the cement. Submit tests as per ASTM C117, C142, C123, C40, C289, and C227.
   b. Soundness: Submit tests as per ASTM C88. Loss shall not exceed 8% if tested with sodium sulfate, 10% if tested with magnesium sulfate.
   c. Absorption: Submit tests as per ASTM C127, C128. Absorption of aggregates shall not exceed 1-1/2% unless Architect approves a higher absorption in writing.
   d. The Architect may, at his own discretion, have the proposed concrete mix tested, at the Owner's expense, for resistance to freezing and thawing as per ASTM C666. The criterion of acceptability shall be a relative dynamic modulus of elasticity, Pc, as per ASTM C666, not less than 85% after 300 cycles of freezing and thawing. Size of test specimens shall be as recommended in ASTM C666.

5. Abrasive aggregate shall be aluminum oxide grains, passing a No. 8 mesh screen and retained on a No. 30 mesh screen. Grains shall be well graded and bonded together.

D. Water: Water for mixing and curing concrete shall be clean, fresh, potable, free of oils, acids, alkali, chlorides, fluorides, nitrates, organic materials, and other deleterious substances.

E. Reinforcement and other metal elements:

1. Reinforcement bars shall conform to ASTM A615, Grade 60, except that #11, #14 and #18 bars shall be either Grade 60 or 75, as shown on structural drawings, and that #20 shall be as manufactured by Dywidag Systems, 80,000 psi yield.
2. Welded wire fabric shall conform to ASTM A1064.
3. Reinforcement bars and welded wire fabric for use in concrete exposed to weather and/or otherwise corrosive environment, and in areas indicated on the drawings, shall be cleaned and coated with epoxy in accordance with ASTM A775. Bar supports and other accessories used in these areas shall also be epoxy coated.
4. Provide approved bar supports, spacers, and other placing accessories whether or not shown on Contract Drawings so that reinforcing is not displaced during construction or casting of concrete beyond tolerances specified. Accessories shall not mar or discolor or be visible on hardened concrete surfaces, nor create any planes of weakness in the concrete.

   a. Bar supports shall be able to support a static load of 250 pounds at any point without permanent deformation.

5. Other metal elements in contact with concrete surfaces shall be stainless steel or encased with hard durable plastic for a length of 3/4 inch minimum, measured perpendicular to the plane of the concrete surface, or these elements may be entirely of plastic. All metal elements within 1-1/2 inches of a concrete surface finally exposed to the weather shall be made of stainless steel or zinc coated.

F. Macro Synthetic Fibers: Macro fibers shall be a coarse monofilament, polypropylene/polyethylene blend in accordance with ASTM C1116 Paragraph 4.1.3, Type III. Macro fibers shall measure 1.5" to 2" in length and shall have a post-crack residual strength value (fe3) of 200 PSI measured in accordance with ASTM C1609 (Standard Test Method for Flexural Performance of Fiber Reinforced Concrete). Fiber manufacturer shall provide data demonstrating conformance with these requirements. Provide one of the following:

1. "Tuf-Strand SF" by The Euclid Chemical Co.
2. "Strux 90/40" by W. R. Grace & Co.

G. Expansion joint filler: Shall be approved non-extruding, non-staining filler of polyurethane or sponge rubber, conforming to ASTM D1752 (non-extruding and resilient non-bituminous types).

H. Waterstops: The following types of waterstops are acceptable, subject to Architect's approval:

1. PVC: Waterstops shall be certified by the manufacturer to be virgin polyvinyl chloride compound, containing no reclaimed material, and shall have the following properties, with corresponding test method:

   a. 2000 psi minimum tensile strength (ASTM D412).
   b. 300% minimum elongation (ASTM D412).
   c. -25 °F low temperature brittleness (ASTM D746).
   d. 0.15 maximum water absorption (ASTM D570).
   e. Effective with a temperature range from -25 °F to +176 °F.
   f. Retain basic characteristics when subjected to acid, alkalis, sea water, chlorinated water, sodium chloride, caustic soda, sodium carbonate, and lubricating and diesel oil.

2. Sodium Bentonite: Waterstops shall consist of a minimum 75% sodium bentonite.

I. Vapor barrier: Unless specified otherwise in the Geotechnical Report, provide vapor barrier which conforms to ASTM E1745, Class A. The membrane shall have a water-vapor transmission rate no greater than 0.009 perms when tested in accordance with ASTM F1249. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 15 mil thick. The installation must be approved before the concrete placement. Provide one of the following or approved equal:

1. "Stego Wrap (15-Mil) Vapor Barrier" by Stego Industries LLC.
2. "Husky Yellow Guard 15 Mil Vapor Barrier" by Poly-America.
3. "Premoulded Membrane Vapor Seal with PLASMATIC CORE" by W.R. Meadows Inc.

J. All metal inserts, anchors, bolts, tie wire, and nails for concrete work to be exposed to the weather shall be made of stainless steel or zinc coated.

K. Anchor slots and reglets:

1. Slots for dovetail anchors are furnished in Section 04 20 00 Unit Masonry.
2. Reglet inserts shall be 25-gauge minimum stainless steel sheet metal of an approved type.

L. Liquid densifier/sealer: The liquid densifier compound shall be a siliconate based sealer which penetrates concrete surfaces, increases abrasion resistance, and provides a "low-sheen" surface that is easy to clean and eases the problem of tire mark removal. The compound must contain a minimum solids content of 20% of which 50% is siliconate. Provide one of the following:

1. “Euco Diamond Hard” by The Euclid Chemical Co.
2. “Sealhard” by L&M Construction Chemical Inc.

M. Delivery, storage, and handling of materials:

1. Deliver, store, and handle materials in such a manner as to prevent deterioration. Any material which has been damaged in any way shall not be used in the work.
2. Store concrete aggregates in such manner that moisture content is controlled, foreign materials are kept out, and proper size and gradation are maintained.
3. Store reinforcing bars and welded wire fabric off the ground, protected from the weather, dirt, grease, etc.
4. Protect cement from contamination by foreign matter, moisture, and dampness at all times. Cement containing partially set material shall be rejected.

2.2 ADMIXTURES

A. All admixtures are subject to the written approval of the Architect.

B. Lightweight concrete and concrete exposed to the weather in the completed project shall have an approved air-entraining admixture conforming to ASTM C260 (except that relative durability factor shall be 95) added to the concrete at the mixer.

1. Air entraining admixtures shall be used in strict accordance with the manufacturer's recommendations so that the percentage of total air content as per Section 3.6.D of this specification is consistently entrained throughout the work.
2. The following air-entraining admixtures are acceptable:

a. “Darex AEA” by GCP Technologies
b. “Sika Aer” by Sika Corp.
c. “MasterAir VR 10” or “MasterAir AE 90” by BASF Corp.
d. “Eucon AEA-92” or “Air Mix 250” by The Euclid Chemical Co.

C. Prohibited admixtures: Calcium chloride, thiocycanastes, or admixtures containing more than 0.5% chloride ions are not permitted.

D. The use of admixtures to retard setting of the concrete during hot weather, to accelerate setting during cold weather, or to reduce water content without impairing workability will be permitted if the following conditions are met:

1. The admixture shall conform to ASTM C494.
2. A statement of compatibility from the admixture manufacturer is submitted to the Engineer along with a dosage chart.

E. The following admixtures are acceptable:

1. Water-reducing admixture: ASTM C494, Type A, and containing not more that 0.05% chloride ions. Provide one of the following:

a. “Eucon WR 91” or “Eucon MR” by The Euclid Chemical Co.

b. “MasterPozzolith 322” by BASF Corp.
c. “Plastocrete 161” by Sika Corp.

2. High-range water-reducing admixture (superplasticizer): ASTM C494, Type F or Type G, and containing not more than 0.05% chloride ions. Provide one of the following:

a. “Eucon 37/1037" or "Plastol” series by The Euclid Chemical Co.
b. “Viscocrete 2100” by Sika Corp.
c. “Rheobuild 1000” or “MasterGlenium” series by BASF Corp.

3. Non-chloride, non-corrosive accelerating admixture: ASTM C494, Type C or E, and not containing more chloride ions than present in municipal drinking water. Provide the following or approved equal:

a. “Accelguard 80” or “Accelguard 90” by The Euclid Chemical Co.

4. Water-reducing, retarding admixture: ASTM C494, Type D, and containing not more than 0.05% chloride ions. Provide one of the following:

a. “Eucon Retarder 75" by The Euclid Chemical Co.
b. “MasterSet R 100” by BASF Corp.
c. “Plastiment” by Sika Corp.

5. Corrosion inhibitor (where called for in these specifications or on the drawings): 30% calcium nitrite. Subject to compliance with requirements, provide one of the following at 3 gal/cy:

a. “Eucon CIA” by The Euclid Chemical Co.
b. “DCI” by W. R. Grace & Co.
c. “Sika CNI” by Sika Corp.

6. Hydration Stabilizer: A liquid chemical admixture specially formulated to suspend the hydration of concrete for extended periods of time. Provide one of the following:

a. “Eucon Stasis” by The Euclid Chemical Co.
b. “Delvo” by BASF Corp.
c. “Sikatard 440” by Sika Corp.

7. Viscosity Modifying Admixture (VMA): Liquid admixture used to optimize viscosity of Self-Consolidating Concrete. Provide one of the following:

a. “Visctrol” by The Euclid Chemical Co.
b. “Sika Stabilizer 4R” by Sika Corp.
c. “Rheomac VMA Series” by BASF Corp.

F. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Architect may at his discretion require the use of a water reducing retarder for concrete 2 feet or more thick and for all other concrete whenever the temperature at the time concrete is cast exceeds 90 °F. The admixture shall be selected by the Contractor subject to the Architect's approval. The admixture and concrete containing the admixture shall meet all the requirements of these specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

G. Where more than one admixture is used, all admixtures shall be compatible in the mix design when added separately.

2.3 NON-SHRINK GROUT

A. Non-shrink, non-metallic grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107. In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout shall achieve 95% bearing under a 4’ x 4’ base plate when placed at a fluid consistency. Provide one of the following:

1. “NS Grout” by The Euclid Chemical Co.
2. “Five Star Grout” by Five Star Products Inc.
3. “Sikagrout 212” by Sika Corp.

B. High flow grout: Where high fluidity and/or increased placing time are required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107. In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout shall achieve 95% bearing under an 18” x 36” base plate when placed at a fluid consistency. Provide one of the following:

1. “Hi-Flow Grout” by The Euclid Chemical Co.
2. “Masterflow 928” by BASF Corp.
3. “SikaGrout 328” by Sika Corp.

2.4 CURING COMPOUNDS – MEMBRANE FORMING

A. Clear curing and sealing compound (A.I.M Regulations – VOC Compliant, 350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall not be more than 0.40 kg/m2 when applied at 300 sq.ft./gal. Manufacturer's certification is required. Subject to project requirements, provide one of the following products:

1. “Super Diamond Clear VOX” or “Super Aqua Cure VOX” by The Euclid Chemical Co.
2. “Masterkure CC 1315WB” by BASF Corp.

B. Strippable curing compound (VOC Complaint, 350 g/l): The water based compound shall conform to ASTM C309. Use the specified strippable curing compound on surface to be covered with a finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, damp-proofing, membrane roofing, flooring, painting, and other coatings and finish materials. Provide the following or approved equal:

1. “Kurez DR VOX” by The Euclid Chemical Co.

2.5 BONDING AND REPAIR MATERIAL

A. Bonding compounds: The compound shall be a polyvinyl acetate type.

1. Rewettable: Use only in areas not subject to moisture. Provide one of the following:

   a. “Tammsweld” by The Euclid Chemical Co.
   b. “Weldcrete” by Larsen Products Corp.

2. Non-rewettable: In areas subject to moisture use a polymer modified bonding admixture. Provide the following or approved equal in an approved bonding grout:

   a. “Flex-Con” or “SBR Latex” by The Euclid Chemical Co.

B. Polymer patching mortar: These patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Engineer is required. Provide one of the following:

1. "Thin Top Supreme", "Concrete Top Supreme", or "Tammspatch II" (horizontal repairs); "Verticoat", "Verticoat Supreme", or "EucoRepair V100" (vertical and overhead repairs) by The Euclid Chemical Co.
2. "Sikatop 111 Plus" or "Sikatop 122 Plus" (horizontal repairs), "Sikatop 123 Plus" (vertical and overhead repairs) by Sika Corp.

C. Epoxy adhesive: The compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces.

1. Designated repairs shall be made, with prior approval of the Engineer as to method and procedure, using the epoxy adhesives and/or epoxy mortar. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by these manufacturers shall be used.
2. Provide one of the following:

a. "Dural 452 LV or MV" by The Euclid Chemical Co.
b. "Sikadur Hi-Mod" by Sika Corp.

D. Anti-corrosive epoxy/cementitious adhesive: This adhesive shall be a water-based epoxy/cementitious compound for adhesion and corrosive protection of reinforcing members (24 hour maximum open time). Product shall be one of the following:

1. "Duralprep A.C." by The Euclid Chemical Co.
2. "Armatec 110 EpoCem" by Sika Corp.

E. High strength flowing repair mortar: For forming and pouring structural members or large horizontal repairs, provide flowable one-part, high strength microsilica modified repair mortar with 3/8" aggregate. The product shall achieve 9000 psi at 28 days at a 9-inch slump. Provide one of the following:

1. "Eucocrete" or "Euco Speed MP" (cold weather) by The Euclid Chemical Co.
2. "Sika MonoTop 611" by Sika Corp.

F. Underlayment compound: Free-flowing, self-leveling, pumpable cementitious base compound.

1. The compound shall exhibit the following properties:

a. Compressive strength (ASTM C109):

1) 3500 psi at 7 days
2) 5000 psi at 28 days

b. Bond strength (ASTM C1042)

1) 700 psi at 7 days
2) 1000 psi at 28 days

2. Provide one of the following or approved equal:

a. "Flo-Top" by The Euclid Chemical Co.
b. "EucoFloor SL 160" by The Euclid Chemical Co.

G. Repair topping: Self-leveling, polymer modified high strength topping.

1. The topping shall exhibit the following properties:

a. Chaplin Abrasion Test: 0.02 mm (0.0079 in.) maximum at 28 days (British Standard 8204).

2. Product shall be one of the following:

a. “Thin Top Supreme” or “Tammspatch II” by The Euclid Chemical Co.
b. “SikaTop 121 Plus” by Sika Corp.

PART 3 - EXECUTION

3.1 FORMWORK

A. The Contractor shall be responsible for the design, construction, and bracing of all formwork and temporary falsework as required to safely support concrete and hold safe personnel during construction. Formwork and falsework shall conform to ACI 347 “Guide to Formwork for Concrete,” except as modified herein. Formwork and temporary bracing shall be designed to resist wind and other applicable loads specified in the Building Code.

B. Formwork and falsework shall be designed and installed in such a way to ensure that the wet concrete does not exert lateral pressures on adjacent structure unless it is demonstrated that the adjacent structure is able to withstand such pressures.

C. Forms shall be substantially built and of sufficient strength and rigidity to produce finished concrete of the precise size, shape, and location shown on drawings without exceeding specified tolerances. Their assembly shall permit removal in proper sequence without damage to concrete.

D. Formwork shall be clean and free of ice, frost, papers, sawdust, dirt, and debris when concrete is placed thereon. Provide temporary cleanout panels in column and wall forms and other forms where necessary to facilitate cleaning and inspection.

E. Construct forms for windows, doors, louvers, beams, pockets, slots, floor penetrations, and any other opening in concrete. Before concrete is placed, check all elements to be built in the forms for completeness, size, and location.

F. Construct forms of materials that will produce concrete surfaces suitable for use intended. Make joints in formwork sufficiently tight to prevent the leakage of cement paste or grout.

1. For surfaces that are not exposed to view in the finished project, undressed lumber, form plywood, or any other suitable material may be selected by the Contractor. Lumber to be reused shall have nails and metal fasteners withdrawn.
2. Standard plywood forms of grade “exterior plyform” not less than 5/8 inch thick shall be used to form areas exposed to view in the finished project.
3. Joints between panels shall be well backed and shored so that concrete surfaces free of objectionable offsets, form marks, and projections are produced. Remove any objectionable projections remaining after forms are stripped by means of machine grinding.

G. Formwork for finished concrete surfaces may be treated with an approved form coating, which will not stain or discolor the hardened concrete. Form coating for concrete surfaces to be painted shall

not contain wax nor any substance that might destroy bond of paint to surface. Form coating for untreated timber forms shall be of the lacquer base type.

3.2 REMOVAL OF FORMS

A. Do not remove forms until the concrete has attained sufficient strength to support its own weight and construction live loads to be placed thereon, without damage to the structure. The Contractor shall be responsible for proper removal of forms and maintenance of safe working conditions for personnel. Repair or replace any work damaged due to improper or early removal of forms to the Architect's satisfaction, at no additional cost to the Owner.

B. When the air temperature falls below 40 °F leave forms or selected portions thereof in place if required in order to protect all concrete surfaces from freezing temperatures for at least 6 days after concrete is cast.

C. In hot weather, forms may be used to cure concrete only if they are sprayed with water regularly and concrete is kept continuously moist.

3.3 PLACING OF REINFORCEMENT

A. Reinforcing steel shall be cut and bent cold to exact lengths and shapes required to comply with approved shop drawings. Approval of shop drawings indicates approval of design and general arrangement. It shall be the Contractor's responsibility to assure that concrete reinforcement will comply with the Contract Drawings within tolerances herein specified.

B. All steel shall be free of paint, oil, dirt, scale, ice, frost, loose rust, or any coating that might reduce the bond with concrete.

C. Securely tie and support reinforcement, including wire mesh, to prevent displacement by construction traffic and/or during casting of concrete. Top bars shall not be allowed to sag below tolerances herein specified. Tie dowels securely in place before embedding same in concrete. Concrete cover shall be uniformly maintained and special care taken at concrete surfaces exposed to weather. Any displacement of reinforcing shall be immediately corrected, and additional supports provided to prevent recurrence. Tolerances for position of reinforcing shall be in accordance with ACI 117 and Section 1.4 of this specification.

D. Lap wire mesh reinforcement a minimum of 6 inches at all edges unless otherwise shown on drawings and wire together.

3.4 SPLICES IN REINFORCEMENT

A. Lapped ends of bars may be placed in contact and securely wired or may be separated sufficiently to permit the embedment of the entire surface of each bar in concrete. Splices in adjacent bars shall be staggered.

B. At the Contractor's option, vertical bars in shear walls and columns may be welded or mechanically spliced. Splices shall comply with the Building Code and the requirements of ACI 318.

C. Splices for epoxy coated bars shall conform to the requirements of ACI 318.

3.5 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items including anchor rods, leveling plates, embedded plates, and angles required for other work attached to or

supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Do not wet set embedded items. Accurately position, support, and secure embedded items against displacing by formwork, construction, or concrete placement operations.

1. Provide No. 3 rebar ties at top and bottom of anchor rods to maintain position or other accepted method.

C. Anchor rods and embedded structural supports incorrectly located or damaged after installation shall be field modified, including repair or replacement, by Contractor.

1. Notify Engineer of defective work. Submit proposed field modifications to Engineer for review and acceptance prior to making corrections.
2. Proposed field modifications shall include design details and calculations, signed and sealed by a licensed Professional Engineer hired by Contractor.
3. Field modifications shall be tested in accordance with Section 051200. Perform pull-out tests and other appropriate tests on each repair.
4. Cost of field modifications shall be borne entirely by Contractor at no additional cost to Owner. Contractor shall reimburse Owner for cost of additional testing required.

3.6 CONCRETE QUALITY AND PROPORTIONING

A. Concrete shall be proportioned in accordance with ACI 211.1 and ACI 211.2. The mix design shall be prepared in accordance with Section 4.2.3 of ACI 301. The mix design shall be submitted for approval by the Structural Engineer of Record, together with data regarding cementitious materials, aggregates, and admixtures prior to the start of construction.

B. Water-Cementitious Materials (w/cm) ratio: For normal weight concrete the maximum water-cementitious materials ratio shall typically be 0.45. Architectural Concrete shall have a maximum water-cementitious materials ratio of 0.40. All concrete subject to freezing and thawing or required to be watertight shall have a maximum water-cementitious materials ratio of 0.45 and shall have a minimum compressive strength of 4,500 psi at 28 days. All reinforced concrete subjected to brackish water, salt spray, or deicers shall have a maximum water-cementitious materials ratio of 0.40 and shall have a minimum compressive strength of 5,000 psi at 28 days.

1. The above criteria need not apply to light weight concrete.

C. Slump: Concrete containing a high-range water-reducing admixture (superplasticizer) shall have a maximum slump of 9” unless otherwise approved by the Engineer. The concrete shall have a water slump of 2” to 3” (3” to 4” for concrete receiving a “shake-on” hardener or lightweight concrete). Then, the high-range water-reducing admixture shall be added to increase the slump to the approved level. All other concrete shall have a maximum slump of 4”.

D. Air content: For all air-entrained concrete, the following percentage of total air content, by volume, shall be consistently entrained throughout the work:

1. Concrete subject to vehicular traffic shall have the following air content:

Nominal Max. Size Aggregate (in.)	Total Air Content Percentage
3/8	6 to 9
1/2	5.5 to 8.5
3/4	4.5 to 7.5

1	4.5 to 7.5
1-1/2	4 to 7

2. All other concrete (typical):

Nominal Max. Size Aggregate (in.)	Total Air Content Percentage
3/8	4.5 to 7.5
1/2	4 to 7
3/4	3.5 to 6.5
1	3 to 6
1-1/2	3 to 6

3. For concrete with f'c greater than 5,000 psi, the total air content percentage specified in section 3.6.D.2, above, may be reduced by 1 percent in accordance with ACI 318 section 4.4.1. No reduction in air content is permitted for concrete subject to vehicular traffic.

E. Temperature: Concrete temperature at time of placement shall not exceed 95 °F, except as otherwise indicated elsewhere in this specification.

F. If the proposed mix designs are based on trial mixes, the proposed mix shall provide a 1200 psi over-design in accordance with ACI 318. This over-design shall be $1.10f_c'$ + 700 psi for concrete strengths in excess of 5,000 psi.

G. Admixture usage: All concrete must contain the specified water-reducing admixture or the specified high-range water reducing admixture (superplasticizer). All concrete required to be air entrained shall contain an approved air-entraining admixture.

H. Self-consolidating concrete (SCC): All Architectural Concrete and heavily reinforced concrete so noted on the plans shall be cast using self-consolidating concrete. Proper workability, pumpability, finish, and setting time of the proposed mix design must be verified with a successful test placement onsite. All self-consolidating concrete shall contain the specified high-range water-reducing admixture and viscosity enhancing admixture, when and as required. The spread shall be between 20"-30". The target spread, ±2", shall be based on a successful placement onsite.

I. High performance concrete at parking structures: All reinforced concrete in parking structures shall have a maximum water-cementitious materials ratio of 0.40, air content as specified in Section 3.6.D.1, and shall have a minimum compressive strength of 5,000 psi at 28 days. Unless otherwise specified on the drawings, the approved corrosion inhibiting admixture shall be used in all horizontal parking surfaces at a rate of 3 gallons per cubic yard. All slabs must be moist cured for 7 days and subsequently sealed with the specified penetrating anti-spalling sealer after a minimum of 3 days of air drying.

J. Mass Concrete: The following consideration shall be given to all concrete when the minimum cross-sectional dimension exceeds 2-1/2 feet:

1. Temperature of the as-placed concrete shall not exceed 70 °F.
2. Temperature of concrete after placement shall not exceed 158 °F.
3. Maximum temperature differential between any surface and the center of concrete cross section shall not exceed 35 °F.
4. Fly ash content shall not exceed 50% of cementitious materials.
5. Slag content shall not exceed 80% of cementitious materials.
6. The Contractor shall submit, prior to construction, a thermal control plan for each mass concrete placement. The plan shall include concrete mix design, description of methods to

ensure that the above temperature limits will be maintained, taking into account varying weather conditions, as well as means of temperature monitoring and reporting to the Architect.

7. The proposed mix design for elements meeting the requirements of mass concrete may be subject to a successful test placement on site prior to approval by the Engineer.

K. The concrete shall be of such consistency and composition that it can be worked into the corners and angles of the forms around the reinforcement without permitting the materials to segregate or free water to collect on the surface.

L. Consult with the manufacturer of the lightweight aggregate to establish the proportions of the mixture, including cement content, to produce the required strength and weight, but not less than required by the Building Code. The lightweight concrete shall have a unit weight of 115 lbs/cf ±2 lbs/cf at equilibrium.

M. If, during the progress of the work, it is found difficult to consistently secure concrete of the desired workability, feasibility, and setting time of required strength with the mix design furnished by the Contractor, the Engineer may order changes in proportions of materials or admixtures, or both, as may be necessary to secure the specified concrete properties. Any changes so ordered shall be made at the Contractor's expense. The source of supply of the aggregate and cement shall not be changed during the course of the job without previous notice to the Architect, and the material from any new source shall be subject to acceptance or rejection as based on complete new sets of preliminary tests. All expenses in connection with such tests shall be borne by the Contractor.

N. Measure materials for concrete by weighing. Weigh each size of aggregate and the cement separately. Cement weight and water volume shall be accurate to within ±1%. Each size of aggregate weight shall be accurate within ±2%. Admixtures should be measured to within ±3%. Measure mixing water by volume. Use moisture meters to measure the moisture content of the aggregates. Make necessary adjustment to batch weights to compensate for variations in aggregate moisture before batching by protecting and properly draining aggregates, especially fine aggregate. Maintain a uniform stable moisture content in the fine aggregate not in excess of 6%.

3.7 MIXING AND PLACING CONCRETE

A. Provide mixing equipment capable of combining the aggregates, cement, and water into a thoroughly mixed, uniform mass and of discharging the mixture without segregation. The volume of each batch shall not exceed the manufacturer's rated capacity of the equipment.

B. The re-tempering of concrete, which has partially hardened, will not be permitted. Remove such concrete from the site.

C. Mix and transport ready-mixed concrete in accordance with the current edition of ASTM C94, “Standard Specification for Ready-Mixed Concrete,” except as modified herein.

1. The use of non-agitating equipment to transport concrete will not be permitted.
2. Place all concrete in its final location in the work within 1-1/2 hours after the introduction of the mixing water to the cement and aggregates. In hot weather reduce this time or use suitable approved set retardant admixtures so that stiffening of the concrete will take place only after it has been finally placed.

D. Do batch mixing at the site in mixers conforming to the requirements of the “Mixer Manufacturers Bureau of the Associated General Contractors of America.”

E. All concrete will be periodically tested for proper, uniform mixing by the Laboratory. The mixer performance shall conform to tests and degree of uniformity specified in ACI 304.

F. For lightweight concrete, use one of the following batching and mixing procedures or other effective procedure approved by the Architect:

1. Add the entire weight of pre-dampened aggregates plus the air entraining agent to about 67% of the mixing water and premix for about 1/2 minute or 5 to 10 revolutions of truck mixer. Then add the cement, other admixtures if required, followed by the balance of the water and mix as specified.
2. Use the mixer to pre-dampen lightweight aggregate by premixing the aggregate and about 67% of water for about 1-1/2 minutes or 5 to 30 revolutions of truck mixer. Add the air-entraining admixture and concrete premix for 1/2 minute or 5 to 10 revolutions. Add the cement, other admixtures if required, and balance of water and mix as specified.

G. Before placing concrete, remove hardened concrete, foreign matter, debris, ice, frost, snow, and all free water from forms and from all placing and conveying equipment. Moisten subgrades sufficiently to avoid drawing cement grout from concrete placed thereon.

H. Conveying and placing equipment shall be of a size and design so that concrete of the specified consistency (slumps within those specified) can be practically handled and conveyed from the mixer to the place of final deposit without delays, segregation, or intrusion of foreign matter.

1. Belt conveyors and chutes shall be within a length which will not seriously alter the slump of the mix between the mixer and the place of deposit. Chutes shall not be longer than 30 feet unless approved by the Architect.
2. Chutes shall have a slope of at least 1 vertical to 3 horizontal. Chutes steeper than 1 vertical to 2 horizontal shall always be discharged into hoppers having 24 inch or longer closed, tapered downpipes.
3. If concrete is to be placed by pumping methods, provide sufficient standby equipment to ensure continuous placement of concrete up to a properly located construction joint. Do not use equipment or conduits with aluminum parts.
4. Protect concrete from weather. Rainwater, snow, and ice shall not be permitted to increase the quantity of mixing water in the concrete.
5. Placement shall be continuous or in layers placed at a rate which will ensure that concrete which is being integrated with fresh concrete is still plastic so that seams or planes of weakness will not be formed within a section of the work.
6. Deposit concrete into the “face” of in-place concrete to prevent segregation. Avoid formation of “rock pockets” by placing concrete so that horizontal flow in the forms is minimized at all times.

I. Place concrete with slumps of 8” ±1” for walls, columns, and deep beams in layers 2 feet or less in depth. Vibrate each layer. Extend the vibrator vertically into the preceding layer to thoroughly bond the layers.

1. Discharge concrete into a hopper with a drop chute so that the concrete will not strike against forms, ties, bars, etc. Limit the free fall below the drop chute to a height which will not cause segregation, not over 5 feet unless approved otherwise by the Architect. Provide side pockets in forms where required. Set hoppers and downspouts at every 5 feet or less along the forms for each layer so that lateral flow of concrete after deposition is minimized.
2. Self-consolidating concrete may be placed full depth.

J. Consolidate all concrete thoroughly by means of mechanical vibrators of the internal type. For difficult placing conditions or heavily reinforced sections, provide supplemental external form vibration. Mechanical vibrators shall have a frequency of 7,000 to 10,000 revolutions per minute and shall be operated by competent workmen.

1. Insert vibrators into the concrete at systematic regular intervals 12 to 30 inches apart for periods of about 5 to 15 seconds at each insertion.
2. Where air bubbles must be expelled use long periods of vibration at each location.
3. Do not use vibrators to transport concrete horizontally.

3.8 CURING AND PROTECTION

A. Throughout construction protect the concrete work and finished concrete surfaces against damage due to excessive loading, construction equipment, materials or methods, ice, rain, snow, excessive heat, and freezing temperatures.

B. Cold weather protection: Whenever the air temperature falls below 40 °F and whenever weather reports indicate that the temperature may fall below 40 °F, have available for immediate use adequate equipment to heat mixing water, heat aggregates as necessary, steam formwork and reinforcing, and moist cure the freshly cast concrete.

1. The temperature of concrete as placed shall be 60 to 75 °F. In order to accomplish this, heat the mixing water and, when necessary, the aggregate. When either the water or the aggregate is heated to temperatures above 100 °F, bring the water and aggregate together first and add the cement and admixture only when the temperature of water plus aggregate is not above 80 °F.
2. Steam formwork and reinforcing steel well in advance of placing concrete so that all snow and ice is removed and the temperature of the forms and reinforcing is above 32 °F.
3. Do not place concrete on frozen or partially frozen subgrade. Subgrade, once frozen, shall be thawed out and re-compacted before concrete is placed thereon. Concrete footings shall be protected from freezing for at least 120 hours from the time the concrete is placed.
4. Provide covering, insulation, and heat so that the temperature of all parts of the concrete is maintained at 70-80 °F for at least 72 hours or 50-80 °F for 120 hours with Type I and II cements, and 70-80 °F for at least 48 hours or 50-80 °F for at least 72 hours with Type III cement from the time the concrete is first placed. Heat the concrete preferably by discharging exhaust steam into the enclosure around the concrete so that the concrete is kept continuously moist throughout the heating period.
5. Allow the concrete to cool gradually at a rate not to exceed 5 °F per any hour, nor more than 40 °F in 24 hours. Alternatively, use only the specified non-corrosive accelerator. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

C. Hot weather protection: In hot weather, control the consistency and temperature of the concrete by the following methods:

1. Shield ingredients and equipment from the sun whenever practicable.
2. Eliminate excessive mixing and handling.
3. Use reflective paint on mixer and conveyances.
4. Transport and place concrete efficiently so that it will not stiffen before it is in place.
5. Consider use of approved water-reducing, retarding admixtures.
6. Use low temperature mixing water.
7. The temperature of the concrete mix when first placed in the forms shall not exceed 85 °F. Take special care in the moist curing of concrete, as described above.

D. When concrete thickness exceeds 2-1/2 feet, protect it from excessive heat of hydration. The temperature of such concrete when placed shall not exceed 70 °F. Steps shall be taken to minimize thermal cracking due to rapid temperature change.

E. Guard against early drying out of concrete, especially during the first 24 hours after placing. Special care to avoid early drying is necessary in dry, windy weather and when thin sections are being cast. Use the specified evaporation retardant one or more times after the strike-off to minimize plastic cracking. Use curing and sealing compounds or water (if moist curing is the preferred method). Commence curing as soon as finishes will not be marred thereby.

F. Curing compounds: Portions of the work may be cured with a curing compound of an approved type providing the following requirements are met:

1. All exposed troweled interior slabs not receiving a penetrating liquid densifier shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and Architectural Concrete not receiving a penetrating sealer shall be cured with the specified clear, non-yellowing curing and sealing compound. Maximum coverage shall be 400 ft^2/gallon on steel troweled surfaces and 300 ft^2/gallon on floated or broomed surfaces for the curing/sealing compound.
2. Do not use curing compounds where they will in any way impair finishes. If the Contractor proposes to cure concrete surfaces which will receive resilient tile or another applied finish with curing compounds, he must guarantee that the bonding of the finish to the concrete will not be weakened and that the finish will not be marred thereby. Curing compounds may be permitted on concrete surfaces exposed to view in the finished project only with the prior written approval of the Architect.
3. Curing compound (strippable): Use strippable curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, damp-proofing, membrane roofing, flooring, painting, other coatings, and finish materials. Apply in strict accordance with manufacturer's written instructions. The curing compounds can be applied by rolling or power spray. Apply immediately after final finishing in accordance with the manufacturer's instructions. Maximum coverage for trowel-finished slabs shall 400 ft^2/gallon and for floated or broomed surfaces 300 ft^2/gallon.

G. Moist cure the concrete for at least 7 days after it is placed. Control the amount of water used so that no additional water will intermingle with concrete as placed. When weather permits, the concrete may be pounded or continuously sprayed, provided it is covered by cotton mats, quilted covers, insulating blankets, or sisal Kraft paper which will keep the concrete continuously moist. Use a covering of a type which is suitable to prevailing weather conditions. Use the curing and sealing or strippable curing compounds as noted. In cold and freezing weather, after temporary heat is removed, cover the concrete with insulating blankets or material which will retain moisture and protect against frost. In hot weather, spray the concrete frequently and provide a cover that reflects sunlight.

H. When forms are used as a means of curing concrete in warm weather, periodically hose them down so that concrete is kept continuously moist. Cover or spray metal forms exposed to the sun to prevent excessive transmission of heat to concrete.

I. At all exposed edges of slab (eyebrows), apply the specified penetrating anti-spalling sealer as per the manufacturer's specification.

3.9 FINISHING OF CONCRETE FLOORS

A. Unless otherwise scheduled or noted, apply the following floor finishes:

1. Roughened base slab: Concrete surfaces which are to receive a bonded, cementitious topping or fill.

2. Floated finish: Concrete surfaces which are to receive roofing, waterproofing, or sand bed terrazzo.
3. Troweled finish: Typical finish for interior floor areas which are to remain exposed or which are to receive carpeting, resilient tile, or other floor covering.
4. Finish for garage floor and ramp: Provide a light-to-medium broom finish or a swirl finish with texture similar to a broom finish. Finish is subject to Architect's approval of test placement.
5. Broomed finish: Exterior slabs on grade, ramps. Finish is subject to Architect's approval of test placement.
6. Liquid sealer/densifier finish: Apply this compound on exposed interior floors subjected to vehicular abrasion and shake on hardener slabs as indicated on the drawings. Application shall be made in strict accordance with the directions of the manufacturer and just prior to completion of construction. Spray, squeegee, or roll on liquid densifier to clean, dry concrete surface. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface shall then be squeegeed or vacuumed to remove all excess liquid.

B. Set edge forms and intermediate screed strips accurately, sufficiently rigid to support screed, vibrating screeds, and strike off templates so that proper surface elevations and concrete thicknesses are achieved.

C. Roughened base slab: Thoroughly consolidate the concrete and bring the top of the concrete to the proper elevation by vibrating, screeding, and power floating. When the concrete has partially hardened so that it will retain impressions brush the surface with stiff bristle broom and/or tamp with a rake so that a roughened surface suitable for bonded topping or fill is produced.

D. Floated finish: Screed the concrete to proper surface elevations. When the concrete has hardened sufficiently so that water and fine materials will not be worked to the top level, compact the surface by means of power driven floats. By means of hand floating with wood or cork faced floats, finally finish the surfaces to a uniform granular texture and a FF25/FL17 tolerance.

E. Troweled finish: Screed and power float the concrete surface as described for a floated finish. Power trowel the surface until it is smooth and relatively free of defects. When the concrete has hardened so that steel troweling produces a "ringing" sound, the entire surface shall be finally troweled. Exert heavy pressure on the trowels. Produce a dense, smooth, even surface free of trowel marks and blemishes. Troweled finish surfaces shall be true to a plane surface and a FF25/FL20 (FL17 for elevated slabs) tolerance. Slightly roughen exposed interior floor surfaces to degree as directed by Architect. Note areas requiring "quick-dry" concrete.

F. Broomed finish: Produce a broomed finish in essentially the same manner as described above for a troweled finish except that the final troweling shall be omitted. Instead, leave the surface with a coarse transverse scored texture by drawing a broom or burlap belt across the surface when the concrete is hard enough to retain surface impressions. Texture shall be as approved by Architect from sample panels.

3.10 REPAIR OF DEFECTIVE CONCRETE

A. Entirely replace, repair, or patch concrete not properly formed, showing defective surfaces when forms are removed, or otherwise not in conformance with drawings and specifications. Plastering over of defects will not be allowed. Defective areas must be chipped out. The Engineer will decide whether to repair or replace, and shall be the judge as to whether or not repairs are satisfactory.

B. Remove bulges and projections by chipping or grinding. Honeycombed and other defective areas must be chipped out to solid concrete, with the edges cut as straight as possible, slightly undercut to provide a key at the edge of the patch.

C. Large and deep repairs may be filled with concrete or the specified high strength flowing repair mortar, held in place by forms. Reinforce and dowel such patches to the hardened concrete. Small areas shall be repaired with the specified polymer repair mortar, unless a color match is required.

D. Provide samples to determine that best proportions of white and gray cements in areas requiring a color match to adjacent concrete.

E. All structural repairs shall be made with prior approval of the Engineer as to method and procedure, using the specified polymer repair mortar and/or specified epoxy adhesive. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used. Exposed slabs shall be repaired prior to the slab being treated with the specified penetrating anti-spalling sealer. In addition, cracks shall be filled with the specified crack sealer or other method as approved by the Engineer.

F. Underlayment application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material. Underlayment application shall achieve the tolerances specified in “Finishing of Concrete Floors”, above.

G. Repair topping: All exposed floors shall be leveled, where required, with the specified self-leveling repair topping.

H. Cure repair areas well, starting as soon as possible after finishing. Use a specified water-base curing compound, wet burlap, or other approved methods over the repair. All repairs must be kept continuously moist for seven days minimum.

3.11 SLABS ON GRADE, INCLUDING SIDEWALKS

A. Begin work on slabs on grade only after the subgrade has been thoroughly compacted as required by the Geotechnical Engineer and after pipes and drains to be located under slabs are placed, tested and approved.

B. Furnish and place a continuous vapor barrier or waterproofing membrane, as required per Geotechnical Report, under all interior slabs on grade. All joints shall be lapped not less than 6 inches and sealed as per manufacturer's recommendations.

C. Compact concrete, screed to grade, and prepare for the specified finish. Support bars and mesh securely on concrete blocks or bar supports or use the following procedure to ensure mesh will be installed at proper depth:

1. For mesh-reinforced slabs, place concrete below mesh first. Then place mesh. Follow up by placing the concrete over the mesh within 45 minutes or less so that the upper layer is cast and compacted while the lower layer is still plastic.

D. Provide construction and contraction joints and reinforcing as detailed on the drawings.

3.12 CONSTRUCTION AND EXPANSION JOINTS

A. Construction joints shall be in accordance with the requirements of ACI 318.

1. Horizontal construction joints will not be permitted except where shown on the drawings or approved by the Architect upon request in specific cases.

2. When placing new concrete at a construction joint, thoroughly clean and cover the older concrete. Use an approved epoxy cementitious adhesive within a 24 hour open time.
3. Install approved water stops at construction joints as shown on Architectural drawings. Follow all manufacturer splicing and installation requirements.

B. Expansion joints: Provide where indicated and as shown on plans and details. Install water stops, joint filler strips, and joint sealer. Galvanized nails or clips shall protrude from one side of joint filler for embedment in the concrete to prevent displacement or filler strips. Edges of joints, which are to be exposed to view, shall have neatly tooled edges.

3.13 GROUTING

A. Provide the specified non-shrink, non-metallic grout. Mix grout as per manufacturer's instructions.

B. Placing: Set and grout all anchor bolts, bases, steel leveling plates, saddles, elevator door sills, and all other items indicated on drawings to be grouted. Grout in openings in concrete around conduit and piping passing through concrete. Pack grout solidly, fill entire area to be grouted, provide complete bearing with no voids. Grout under steel leveling plates shall be poured from one side and worked with wires to provide complete bearing over the entire area.

C. Grouting structural steel base plates: Clean the space between the base plate and concrete using a water jet and dry with an air hose. Pour grout in from one side only, forcing it through to the other side to prevent entrapment of air.

D. High flow grout: Where high fluidity and/or increased placing time are required, use the specified high flow grout. This grout shall be used for all base plates larger than 10 square feet.

3.14 STRUCTURAL MACRO FIBERS

A. All toppings, slabs on metal deck, and exposed non-reinforced slabs on grade so noted on the drawings shall contain the specified macro synthetic fibers used at a rate of 4 lbs./cubic yard to increase toughness, minimize cracking and hold cracks tight.

END OF SECTION 03 30 00

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SECTION 03 35 43 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polished concrete finishing .

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.2 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Cast-in-place concrete subcontractor.
   e. Polished concrete finishing Subcontractor.
2. Review curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Verification: For each type of exposed color.

1.5 INFORMATIONAL SUBMITTALS

1.6 QUALITY ASSURANCE

A. REGULATORY REQUIREMENTS

1. NFSI Test Method 101-A Phase Two Level High Traction Material

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ADA Standards

B. Static Coefficient of Friction: Minimum 0.5 when tested in accordance with ANSI/NFSI B101.1

C. Dynamic Coefficient of Friction: 0.5 when tested in accordance with ANSI/NFSI B101.3

2.2 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.

1. Manufacturer: PROSOCO, Inc: Consolideck Polished Concrete System
2. Manufacturer: Ameripolish
3. Manufacturer: W.R. Meadows: LIQUI-HARD ULTRA
4. Manufacturer: SIKA: Formula One Lithium Densifier MP

B. Proprietary Products/Systems:

1. Hardener, Sealer, Densifier:
2. Joint Filler:
3. Oil Repellent Sealer:
4. Concrete Dyes:
5. Cleaning Solutions:

2.3 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Level 3: High sheen, 800 grit .

B. 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 reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
3. 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.
4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
6. Control and dispose of waste products produced by grinding and polishing operations.
7. Neutralize and clean polished floor surfaces.

3.2 POLISHED CONCRETE STAIN SELECTION .

A. Final Dye/Stain Color will be determined during mock-up review. NOTE: Dye/Stain and appearance is affected by the color of the concrete mix, along with the light source under which it will be reviewed. A list of the selected stains and manufacturers are as follows:

1. PROSOCO, Inc: Consolideck Polished Concrete System:
   a. Mocha
   b. Bronze
   c. Light Roast.
2. Ameripolish:
   a. Raw Sienna
   b. Caramel
   c. Saddle Brown
3. SIKA: Formula One Lithium Densifier MP.
   a. Driftwood
   b. Ponderosa
   c. Leather

END OF SECTION 03 35 43

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SECTION 03 49 00 -GLASS FIBER REINFORCED CONCRETE (GFRC)

Part 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish all materials, labor, equipment, and services necessary for the supply and installation of GFRC components as indicated on the drawings and contract documents.
2. Work shall include supply of GFRC components, installation, patching, repairing, and cleaning.

B. Related Sections:

1. Section 05 12 00 Structural Metal Framing
2. Section 05 10 00 Cold-Formed Metal Framing
3. Section 06 10 00 Rough Carpentry
4. Section 07 92 00 Joint Sealants
5. Section 09 29 00 Gypsum Board
6. Section 09 90 00 Painting

C. Substitutions:

1. Manufacturers desiring to submit proposals other than the specified GFRC shall, at least 10 days prior to the bid date, submit to the Architect all descriptive information of the system. These Manufacturers must have a minimum of three years' experience with the system, provide photographs, and shop drawings of at least three projects similar in detail and scope with names, addresses and phone contacts of the respective Architects and Installation Contractors. Independent test data showing compliance with the specified system and three samples of similar details must also be submitted.

1.3 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D638 Standard Test Method for Tensile Properties of Plastics
2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
3. ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
4. ASTM C947 Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam with Third-Point Loading)
5. ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
6. ASTM D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and 30°C with a Vitreous Silica Dilatometer
7. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products
8. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements

and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

9. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
10. ASTM G23 Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

1.4 SUBMITTALS

A. Submit a minimum of three 3" x 3" or 8" x 8" GFRC flat samples to the Architect for review.

B. Submit shop drawings for approval showing plans, sections, details, joint treatment, reinforcing, fastening devices and the relation of the GFRC components to the surrounding construction.

C. Product Data: Submit manufacturer's technical data.

1.5 RESPONSIBILITY

A. The Installation Contractor shall install and work under this section and he will be responsible for coordinating the installation with other trades.

1.6 MOCK-UP

A. Prior to production, erect one proto-type component on-site for review by the Architect.

1.7 DELIVERY, STORAGE, HANDLING AND PROTECTION

A. Transport and handle units in a manner that avoids excessive stresses or damage.

B. Components displaying obvious damage must be rejected at site at time of delivery.

C. Store the components in a weather protected environment, on level surfaces, with temporary supports as required. Do not stack or lean.

1.8 Warranty

One year from substantial completion.

PART 2. – PRODUCTS

2.1 MANUFACTURER

A. CastWorks by Armstrong World Industries, Inc.

B. Or Approved Equal

2.2 MATERIALS

A. CastWorks GFRC components shall be asbestos free and prefabricated with portland cement, polymers, aggregates, and reinforced with chopped strand fibers.

B. CastWorks GFRC components shall be suitably reinforced with steel.

C. Fabrication will be as per approved shop drawings and will not include framing or assembly. If multiple components are required to complete design criteria as per contract drawings, additional site work under related sections, installation or finishing may be required.

D. Finishes:

1. .

2. Sandblast texture, integrally colored in one of CastWorks GFRC 12 standard colors- PEBBLE BEACH

2.3 TOLERANCES (FABRICATION)

A. Dimensional - all directions +/- 1/8"
B. Thickness - skin +/- 1/8"
C. Warpage or Bowing +/- 1/16"/foot
D. Site conditions and normal manufacturing variations may require additional site work to maintain these tolerances.

2.4 PHYSICAL PROPERTIES

A. Shell Thickness ½"
B. Weight (depending on shape and reinforcement) 4 - 7 lbs/sq.ft
C. Density 130 - 140 lbs/cu.ft
D. Compressive Strength (ASTM C-109-92 Mod.) 9,810 psi.
E. Flexural Strength (ASTM C-947-89 Mod.) 2,562 psi.
F. Modulus of Elasticity - In Flexure (ASTM D638) 2.28 x 10^6 psi.
G. Tensile Strength (ASTM D-638) 940 psi.
H. Impact Strength (ASTM D-256-93a; Notched) 1.30 ft-lbs/in of notch
I. Coefficient of Linear Thermal Expansion (ASTM D-696) 0.60 x 10^{-5}/˚F
J. Humidified Deflection (ASTM C-473-95) No Measurable Value
K. Thermal Conductivity (ASTM C-177-85) 4.35 Btu-in/hr-ft^2-˚F
L. Fuel Contribution (ASTM E-136-98a) Complied with requirements
M. Flame Spread (ASTM E-84-98) 0, Class A
N. Smoke Index (ASTM E-84-98) 0, Class A
O. Resistance to Weathering (ASTM G-23-93) Class 5, Negligible color alteration
P. Screw Withdrawal (standard lab procedure) 346 lbs
Q. Fiber Content 4% - 6% by weight

3.0 EXECUTION

3.1 PRE-INSTALLATION RESPONSIBILITY

A. Field Measurements: Prior to manufacturing, the Installer will be responsible for obtaining all field dimensions for inclusion on the Manufacturer’s shop drawings.

B. Coordination: The Installer will be responsible for the co-ordination of the installation with related sections, within the tolerances specified in the respective articles.

C. Discrepancies: Prior to installation, the Installer shall check job site dimensions and conditions. Any discrepancies between design and field dimensions shall be brought to the attention of the General Contractor and the Architect.

3.2 INSTALLATION

A. Components shall be lifted/handled with suitable devices.

B. Handle units with clean gloves.

C. Components shall be installed plum and true. Shim where necessary.

D. Pre-drill and countersink to 1/8" minimum below finished surface of unit if required.

E. Fasten components with stainless steel fasteners through embedded steel or face of GFRC as indicated on shop drawings.

F. Use PL Premium construction adhesive where indicated on shop drawings.

G. Where components are suspended, use as a minimum 12 gauge galvanized steel wire and the suspension points indicated on the shop drawings.

H. Framing, hangers, etc., as specified elsewhere.

I. Joints are to be caulked as specified under Sealants and Caulking.

3.3 PATCHING AND CONTROL JOINTS

A. Introduce control joints as required (35'-0" O.C.) under related section of the Specification.

B. Patch any damage to match component texture, using mix and sealer provided by the manufacturer.

3.4 CLEANING

A. For integrally colored GFRC, use a liquid soap and warm water solution for mild stains. For tougher stains, use a light duty concrete cleaner. Call Castworks on 1-800-268-4534 and speak with a technical representative before cleaning GFRC.

END OF SECTION 03 49 00

SECTION 03 54 00 - SELF-LEVELING TOPPINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 General Requirments, apply to this Section.

1.2 SUMMARY

A. This Section includes floor patching / leveling over existing substrates to provide a smooth floor surface on interior surfaces only.

1.3 REFERENCES

A. ASTM C 109M, Compressive Strength Air-Cure Only

B. ASTM C348, Flexural Strength of Hydraulic-Cement Mortars

C. ASTM E84, Surface Burning Characteristics of Building Materials

D. ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes

E. ASTM F1869, Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F. ASTM 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

1.4 SUBMITTALS

A. Furnish product data, samples, laboratory test reports, and materials certificates as specified in Section "Cast-In-Place Concrete."

1.5 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Maintain copy of manufacturer’s installation instructions on site, with criteria for preparation and application.

PART 2 - PRODUCTS

3.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pre-packaged topping mixes that may be incorporated in the Work include, but are not limited to, the following:

1. K-15, Ardex Inc.
2. Mapei Novaplan II .
3. Other products equal to above.

B. Design mix to produce topping material with the following characteristics:

1. Compressive strength: Minimum 4000 psi at 28 days.

C. Absolutely no gypsum based products will be allowed on the project.

3.2 MIXING

A. Site-mix per-packaged materials in accordance with manufacturer's instructions.

B. Mix to a consistency to achieve self-leveling.

C. Do not add water unless otherwise instructed, in writing, in the manufacturer's installation instructions and approved by the Architect.

D. Do not add additional aggregate unless otherwise instructed, in writing, in the manufacturer's installation instructions for extending.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

A. Topping Applied to Hardened Concrete: Remove exiting floor finishes as required. Remove dirt, loose material, oil, grease, paint, or other contaminants, leaving a clean surface. Remove high points and projections from concrete.

B. Non-porous subfloors such as ceramic and quarry tile as well as terrazzo should be clean and free of all waxes and sealers.

C. Joints: Mark locations of joints in base slab so that joints in top course will be placed directly over them.

3.2 PLACING AND FINISHING

A. Apply products in accordance with manufacturer's instructions on floor surfaces. Do not proceed with installation until unsatisfactory conditions are corrected. Screed level in accordance with following tolerances:

1. Tolerances: Maximum variation of surface flatness shall not exceed 1/8 inch in 10 feet.

B. Steel trowel any surfaces which are scheduled to receive ceramic tile or to be exposed.

C. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.

3.3 CURING AND PROTECTION

A. Cure and protect topping applications and finishes in accordance with manufacturer's recommendations.

3.4 PERFORMANCE

A. Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping to perform as a floor finish, will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

3.5 WASTE MANAGEMENT

A. Coordinate with Division 01.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 03 54 00

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SECTION 04 05 23 – MASONRY CAVITY WALL DRAINAGE

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. The work performed under this Section includes the performance criteria, materials, production, and erection of mortar deflection systems for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all drainage pathway protection of wall cavity as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction.

B. Related Requirements:

1. Division 04 – Unit Masonry
2. Division 06 – Sheathing
3. Division 07 – Waterproofing, Insulation, Flashings, Accessories

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, preparation and installation instructions, and tested physical and performance properties of drainage pathway protection systems.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
3. Storage and handling requirements and recommendations.

B. Shop Drawings: Show locations and extent of drainage pathway protection and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining wall systems, and other termination conditions.

C. Samples:

1. Samples for selection: minimum 6 inches by 6 inches. Label samples indicating thickness to be used.
2. Mockup for each type of drainage pathway protection condition.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

C. Field quality-control reports.

D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

E. Warranty Documentation: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer regularly engaged, for the past five years, in the manufacture of masonry cavity wall drainage products of similar type to that specified.

B. Installer Qualifications: Installer shall have no less than five years of experience with products similar to those specified.

C. Pre-installation Meeting: Conduct pre-installation meetings to verify project requirements, substrate conditions, construction documents, details and manufacture's warranty requirements.

D. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacture's original, unopened, undamaged rolls/pallets with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Twenty Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CAVITY WALL DRAINAGE SYSTEM

A. Mortar Deflection Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Building Products Inc.; Mortar Break II.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.

2. Provide the following configurations:

a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. Match product size to cavity size. Cavity should be no more than 0.25" (6.4 mm) wider than 1" (25.4 mm) thick material and 2" (51 mm) thick material, and 0.4" (10.2 mm) thick material should touch both the outer wythe and the inner wall. For cavities larger than 2" (51 mm), place rigid insulation of sufficient height to extend at least 6" (152 mm) above the top of the mortar net against the outside of the inner wythe and of appropriate thickness to reduce the cavity to the appropriate size or add additional layers of mortar net to fill width of cavity.

C. Inspect for and repair holes in flashing immediately prior to installation.

3.3 PREPARATION

A. Clean flashing and weep holes so they are free of mortar droppings and debris immediately prior to installing mortar net.

3.4 INSTALLATION

A. Install one continuous row of trapezoidal shaped mortar net at base of wall and over all wall openings directly on flashing.

B. To prevent mortar bridging between the outer wythe and inner wall, install flashing extending from the bottom of the mortar net to at least 6" (152 mm) above the top.

C. Multiple thicknesses may be installed to match cavity widths and if excessive droppings are expected. Inspection, preparation and installation procedure for multiple thicknesses is the same as for single thickness. When installing multiple thicknesses, align the trapezoidal shaped sections with each other.

3.5 PROTECTION

A. Protect installed product from damage during construction

3.6 FIELD QUALITY CONTROL

A. Inspections by Owner-engaged site representative.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 04 05 23

SECTION 04 20 00 – UNIT MASONRY

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. The work performed under this Section includes the performance criteria, materials, production, and erection of unit masonry for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all unit masonry as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to, the following:

1. Concrete unit masonry
2. Face brick
3. Common (building) brick
4. Mortar and grout
5. Steel reinforcing bars
6. Masonry joint reinforcement
7. Ties and anchors
8. Embedded flashing
9. Miscellaneous masonry accessories

1.3 SUBMITTALS

A. Product data for each different masonry unit, accessory, and other manufactured product indicated.

B. Shop drawings for reinforcing detailing fabrication, bending and placement of unit masonry reinforcing bars. Comply with ACI 315 “Details and Detailing of Concrete Reinforcing” showing bar schedules and arrangement of masonry reinforcement.

C. Samples for verification purposes of the following:

1. Full-size units for each different exposed masonry unit required showing full range of exposed color, texture and dimensions to be expected in complete construction.
   a. Include size variation data verifying that actual ranges of sizes for brick falls within ASTM C 216 dimensions tolerances for brick where dimensioning is indicated.
2. Pigmented and colored-aggregate mortar. Make samples using same sand and mortar ingredients to be used on project.
3. Weep holes and vents.
4. Accessories embedded in the masonry.

D. Material certificates for the following signed by manufacturer and Contractor certifying that each material complies with requirements.

1. Each different cement product required for mortar and grout including name of manufacturer, brand, type and weight slips at time of delivery.
2. Each material and grade indicated for reinforcing bars.
3. Each type and size of joint reinforcement.
4. Each type and size of anchors, ties and metal accessories.

E. Material test reports from a qualified independent testing laboratory employed and paid by Contractor indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated.

1. Mortar complying with property requirements of ASTM C270.
2. Grout mixes. Include description of type and proportions of grout ingredients.
3. Masonry units.

F. Cold –weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

G. Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

H. Qualification data firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects and Owners and other information specified.

I. Results from tests and inspections performed by Owner’s representatives will be reported promptly and in writing to Architect and Contractor.

1.4 QUALITY ASSURANCE

A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 “Specifications for Masonry Structures”, except as otherwise indicated.

1. Revise ACI 530.1/ASCE 6 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2 and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2 and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for installing vent pipes and conduits built into masonry.

B. Inspecting Laboratory Qualifications: To qualify for employment in performing tests and inspection specified in this Section, an independent testing laboratory must demonstrate to Architects satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the progress of work.

C. Preconstruction Testing: Owner will employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other inspecting and testing services required by referenced unit masonry standard or indicated herein for source and field quality control:

1. Brick masonry tests: For each different clay masonry unit type indicated, units will be tested per ASTM C67.
2. Concrete Masonry Unit Tests: For each different concrete masonry unit type indicated, units will be tested for strength, absorption and moisture content per ASTM C140.

3. Mortar properties will be tested per property specification of ASTM C270.
4. Grout compressive strength will be tested per ASTM C 1019.

D. Single-Source Responsibility for Masonry Units: Obtain exposed units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface of visually related surfaces.

E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

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

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for each type of exposed unit masonry construction in sizes approximately 72 inches (1800 mm) long by 72 inches (1800 mm) high by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches (400 mm) long in each exterior wall mockup.
    b. Include lower corner of window opening framed with stone trim at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
    d. Include sheathing, sheathing joint-and-penetration treatment, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

4. Repair one section of limestone facade panel, approximately 1 foot by 1 foot in area, before proceeding with the work.
5. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
6. Protect accepted mockups from the elements with weather-resistant membrane.
7. Approval of mockups 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 mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Do not ship any concrete masonry units before receiving written approval of strength tests from the Architect. Products shipped beforehand will be rejected.

C. Store and handle masonry units off ground, under cover and in dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion and other caused, If units become we, do not place until units are in air-dried condition.

D. Store cementitious materials off ground, under cover and in dry locations.

E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

F. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls, projections and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

    1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls.

C. Stain Prevention: Prevent grout, mortar and soil from staining the face of masonry to be left exposed. Remove immediately any grout, mortar and soil that come in contact with such masonry.

1. Protect base walls from rain-slashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
2. Protect sills, ledgers and projections from mortar droppings.
3. Protect surfaces of window and doorframes. As well as similar products with painted and integral finishes from mortar droppings.

D. Cold-Weather Construction: comply with referenced unit masonry standard for cold-weather construction and the following:

1. Do not lay masonry units that are wet or frozen.
2. Remove masonry damaged by freezing conditions.

E. Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Comply with references unit masonry standard and other requirements specified in this Section applicable to each material indicated.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CLAY MASONRY UNITS

A. General: Comply with the following requirements applicable to each form of brick required.

1. Provide special extruded shapes where indicated and as follows:

   a. For applications requiring brick of form, color, texture and size on exposed surfaces that cannot be produces by sawing standard brick sizes.
   b. For applications where stretcher units cannot accommodate special conditions including those at corners.
2. Provide units without cores or frogs and with all exposed surfaces finished for ends of headers and similar applications that expose brick surfaces that otherwise would be concealed from view.

B. Face Brick Standard: ASTM C216 and as follows:

1. Grade and Unit Compressive Strength: Provide units of grade and minimum average net area compressive strength indicated below:
   a. Grade SW.
   b. 3000 psi.
2. Type FBX.

3. Size: Provide bricks manufactured to the following actual dimensions within the tolerances specified in ASTM C 216:

   a. Modular: 3-5/8 inches thick by 2-1/4 inches high by 7-5/8 inches long.

4. Shape units during manufacture as indicated below:

   a. Extruded.

5. Application: Use where brick is exposed, unless otherwise indicated.
6. Color and Texture: **Basis of Design - Glen-Gery Corporation, Midlothian.**
7. Subjects to compliance with requirements, provide product by one of the following:

   a. Glen-Gery Corporation, Sommerville, NJ.
   b. The Belden Brick, Canton, OH.

C. Face Brick (Soldier Course): ASTM C 62 and as follows:

1. Match Face Brick– provide samples to Architect for approval.

2. Grade and Unit Compressive Strength: Provide units of grade and minimum average net area compressive strength indicated below:
   a. Grade SW
   b. 3000 psi
   c. Type FBX
3. Size: Provide bricks manufactured to the following actual dimensions within the tolerances specified in ASTM C 216:

   a. Modular: 3-5/8 inches thick by 2-1/4 inches long by 7-5/8 inches high.

4. Shape units during manufacture as indicated below:

   a. Extruded.

5. Application: Use where brick is exposed and as shown on architectural elevations
6. Provide soldier course face brick of matching color, texture and size as standard face brick specified.
7. Color and Texture: Match Standard Face Brick
8. Subjects to compliance with requirements, provide product by one of the following:

   a. Glen-Gery Corporation, Sommerville, NJ.
   b. The Belden Brick, Canton, OH.

2.3 CONCRETE MASONRY UNITS

A. Comply with requirements of ASTM C 90, latest edition and as indicated below, applicable to each form of concrete masonry unit required, whether hollow units or solid units.
1. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified dimensions within tolerances as specified in ASTM C 90.
   a. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights indicated on drawings.
2. Moisture Content: Provide Type I, moisture-controlled units.
3. Exposed Faces: Manufacturer’s standard color and texture, unless otherwise indicated.

4. Strength: See Table 3, ASTM C 90.
5. Water Absorption: See Table 3, ASTM C 90.
6. Weight: See General Notes.

B. Shapes: Provide shapes indicated on Drawings and in this Section.

1. Provide special shapes for corners, jambs, sashes, movement joints, headers, bonding, and other special conditions, as can be reasonably inferred from floor plans and elevations.
2. Provide square-edged units for outside corners, unless otherwise indicated.
3. Provide bull-nose corners for interior locations, unless otherwise noted.
4. Provide special shapes as required to maintain precise patterns of joints.
5. Provide units with two or more finished faces as required to maintain consistent appearance on all exposed surfaces of masonry construction.
6. Provide polished surfaces for cut units.
7. Provide factory formed lipped units for heads at windows and openings formed from solid CMU units. Refer to drawings for profiles required.

C. Absorption: Maximum allowable water absorption shall be 10 pounds per cubic foot, average of five units. Units when delivered to site shall have moisture content not exceeding 8% by weight.

D. Shrinkage: Drying shrinkage shall not exceed 0.25% average for five (5) specimens, when tested according to ASTM C-426.

E. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen. Available products include:
   a. Grace Construction Products; Dry-Block.

F. Mortar And Grout Materials

1. Water-Repellent Admixture: Dry Block Liquid water repellent admixture shall be added to the mortar while mixing.

2.4 MORTAR AND GROUT MIXES

A. General: Do not add mixtures including 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. Mortar: Comply with ASTM C 270, Type S.

C. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.

2.5 REINFORCING STEEL

A. Shall conform to ASTM A615, Grade 60.

2.6 JOINT REINFORCEMENT

A. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:

1. Hot-dipped galvanized carbon steel wire, coating class as required by referenced unit masonry standard to application indicated.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less that 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:

1. Wire Diameter for Side Rods: 0.1483 inch (9 gauge).
2. Wire Diameter for Cross Rods: 0.1483 inch (9 gauge).
3. For multi wythe masonry provide type as follows:

a. Ladder design with diagonal cross rods spaced not more than 16 inches o.c. and number of side rods as follows:
1) Number of side Rods for Multi Wythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 inches in nominal width plus one side rod for each style of masonry 4 inches or less nominal width.

C. 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. AA Wire Products Co.
2. Dur-O-Wal, Inc.
3. Heckmann Building Products, Inc.
4. Hohmann & Barnard, Inc.

2.7 TIES AND ANCHORS, GENERAL

A. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Stainless steel, 18-8, type 316.
3. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
4. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
5. Wire Size for Veneer Ties: W2.8 or 0.188-inch (4.8-mm) diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m) with prefabricated corner and tee units.

B. Steel Plates and Bars: ASTM A 36, hot-dip galvanized to comply with ASTM A 123 or ASTM 153, Class B3, as applicable to size and form indicated.

C. 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. Heckmann Building Products, Inc. – Basis of Design: Pos-i-Tie
2. AA Wire Products Co.
3. Dur-O-Wal, Inc.
4. Hohmann & Barnard, Inc.

2.8 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STRUCTURAL FRAMEWORK

A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it.

B. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4inch diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch of masonry face and as follows:

1. Wire Diameter: 0.1875 inch.

2.9 RIGID ANCHORS

A. Provide straps of form and length indicated, fabricated from metal strips of following width and thickness:

1. 1/1/2 inches wide by 1/4inch thick.

2.10 ADJUSTABLE MASONRY VENEER ANCHORS

A. General: Provide toe-piece assemblies allowing vertical or horizontal differential movement between wall and framework parallel to plane wall, but resisting tension and compression forces perpendicular to it; for attachment over sheathing to metal studs; and with the following structural performance characteristics.

1. Structural performance Characteristics: Capable of withstanding a 100lb/ft load in either tension or compression without deforming over, or developing play in excess of, 0.05inch.

B. Screw-Attached Masonry Veneer Anchors: Unites consisting of wire tie section and metal anchor section complying with the following requirements:

1. Wire Tie Shape: Triangular.
2. Wire Tie Length: As required to extend 2 inches into masonry wythe of veneer face.
3. Anchor Section: Sheet metal plate, with screw holes top and bottom and with raised, rib-stiffened strap stamped into the center to provide slot between strap and plate for connection of wire tie; of overall indicated below:

a. Size: Plate and Strap size: 1-1/4 inches wide for plate, 5/8 inch for strap by lengths indicated bellow; slot clearance formed between face of plate and back of strap at maximum rib projection: 1/32 inch plus diameter of wire tie.
   1) Plate and Strap Lengths: 6 inches and 3-5/8 inch; with both sides of plate stiffened by ribs.

C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Screw-Attached Masonry Veneer Anchors:

a. "D/A 213", Dur-O-Wal, Inc.
b. "X Seal Anchor system", Hohmann & Barnard, Inc.

2.11 MISCELLANEOUS ANCHORS

A. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.

B. Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336 inch (22 gauge) sheet metal.

C. Anchor Bolts: steel bolts complying with A 307, Grade A; with ASTM A 563 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.

D. Anchors for Tying New Brick Masonry to Existing Masonry: 1-1/2 inch x 14 gauge hot dipped galvanized corrugated box anchor with 1/4inch x 1 inch galvanized metal hit anchor as manufactured by Hilti.

2.12 EMBEDDED FLASHING MATERIALS

A. Elastomeric Fabric Flashing: Fabricate to comply with requirements of Division 7 Section "Elastomeric Flashing" and below:

1. 60 mil thick uncured neoprene.

B. Sheet Metal Flashing (alternatively): Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Work and Flashing" and below:

1. Stainless Steel: 24 gauge.
2. Application: use where flashing is fully or partially concealed in masonry wall.

C. At all wall opening, window sills, coping and parapet walls: Flashings should project a minimum of ½" from the face of masonry.

2.13 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

B. Weep holes: Weep holes shall be screened to prevent clogging with backfill materials. Weep holes for masonry veneer are required at a maximum spacing of 2'-8" in the vertical joints at the base of the bottom course. Provide mesh filler in cavity at weep locations. Provide drip slots in the masonry at the window heads to minimize excessive water runoff or leeching.

1. Provide the following or equal: HB "Quadro-Vent", polypropylene honeycomb design allowing passage of moisture from cavity to the building exterior while restricting ingress of insects and other debris. Color to be selected by Architect.

C. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.

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. Hohmann & Barnard, Inc.; DW-10-X-Seismiclip, X Seal System.

2. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (152 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (152 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
3. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
4. Fabricate wire connector sections from 0.25-inch- (6.35-mm-) diameter, stainless-steel wire.

2.14 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2cup dry measure) dissolved in one gallon of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence and other new construction stains from masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating and wetting agents.
2. Available Products: Subject to compliance with requirements, a product that may be used to clean unit masonry surfaces includes, but is not limited to, the following:

a. "Sure Klean No. 6000 Detergent", ProSoCO, Inc.

2.15 SOURCE QUALITY CONTROL

A. Brick Tests: For each type and grade of brick indicated, units will be tested by qualified independent testing laboratory per ASTM C 67 except 5 bricks will be selected at random for each 100,000 units or fraction thereof installed.

B. Concrete Masonry Unit Tests: For each type, class and grade of concrete masonry unit indicated, units will be tested by qualified independent testing laboratory for strength, absorption and moisture content per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions and other conditions affecting performance of unit masonry.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.

B. Thickness: Build Composite walls and other masonry construction the full thickness shown.

C. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full size units without cutting where possible.

3.3 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of referenced unit masonry standard.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and where possible at other locations.

B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

D. Lay concealed masonry will all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back ½ unit length for one half running bond or 1/3 unit length for one third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-In Work: As construction progresses, built-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
2. Where built-in items are to be embedded in cored of hollow masonry units, place a layer of metal plates, beams, lintels, posts and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry as follows:

1. With full mortar coverage on horizontal and vertical face shells.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C. Cut joints flush for masonry walls to be concealed or to be covered by other materials, unless otherwise indicated.

3.6 STRUCTURAL BONDING OF MULTI WYTHE MASONRY

A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bind ties between wythes.

B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. Provide continuity with horizontal joint reinforcement at corners using prefabricated “L” units, in addition to masonry bonding.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but no more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 LINTELS

A. Install lintels where indicated, whether steel or precast.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.9 FLASHING/WEEP HOLES

A. Install flashings as follows:

B. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall and where indicated.

C. Prepare masonry surfaces so that they are smooth and free from imperfections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing before covering with mortar.

D. Install flashing as follows:

1. At lintels and shelves, extend flashing a minimum of 4 inches into masonry at each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and into the inner wythe.
2. At heads and sills, extend flashing as specified above unless otherwise indicated but turn up ends not less than 2 inches to form a pan.
3. Install flashing in masonry veneer walls as specified above but carry flashing up face of back up at wall at least 8 inches.
4. Interlock end joints of ribbed sheet metal flashings by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer and seal lap with elastomeric sealant complying with requirements of Division 7 Section “Joint Sealers” for application indicated.
5. Turn down sheet metal flashings at exterior face of masonry to form drip.

E. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
1. Form weepholes with product specified in Part 2 of this Section.
2. Space weep holes 32 inched o.c.

F. Install regelts and nailers for flashing and other related construction where shown to built into masonry.

3.10 INSTALLATION OF REINFORCED UNIT MASONRY

A. General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.

B. Temporary Formwork: Construct Formwork and shores to support reinforced masonry elements during construction.

1. Construct Formwork to conform shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie and support forms to maintain position and shape during construction and curing of reinforced masonry.

C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

D. 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.

3.11 FIELD QUALITY CONTROL

A. The licensed testing laboratory (Laboratory) will be hired and paid directly by the Owner. The Laboratory will submit reports to the Architect. The Laboratory will provide special inspections of masonry in the field, and will test specimens taken at the site. The Laboratory will employ only qualified inspectors to perform all special inspections and laboratory tests. Alternatively, the Structural Engineer of Record will be hired by the Owner to perform the Special Inspections. The testing and inspection by the Owner's Laboratory or the Structural Engineer of Record in no way relieves the Contractor of responsibility for the required quality.

B. Testing: Tests and evaluations listed in this article will be performed during construction for each 5000sq.ft. of wall area or portion thereof.

1. Concrete Masonry Units will be sampled and tested in accordance with the requirements of ASTM C140. One test, consisting of compressive strength tests on three individual masonry units, will be carried out on samples randomly selected from stockpiles. At least one test will be carried out on each load delivered to the site and on each lot as defined in ASTM C 140.
2. Mortar properties will be tested per property specifications of ASTM C 270.
3. Mortar composition and properties will be evaluated per ASTM C 780.
4. Grout Compressive strength will be sampled and tested per ASTM C 1019.

C. Special Inspections: The Laboratory will have a qualified special inspector at all times when masonry is being placed. All inspections will be done by or under the supervision of a licensed Structural Engineer.

1. Provide Continuous Special Inspections as identified in Section 17 of the applicable building code.
2. Provide Periodic Special Inspections as identified in Section 17 of the applicable building code.
3. Provide either Level 1 or Level 2 Special Inspections, depending on the type of building, as identified in Section 17 of the applicable building code.

D. Test Reports:

1. The Laboratory will transmit 3 copies of test reports to the Architect no later than 2 business days from the date of the test. These reports shall record the following:

    a. The building unit being installed.
    b. The specific location of the masonry being tested including which floor, location in the floor and walls by number, etc.
    c. The specified classification, and characteristics of materials being tested.
    d. The minimum and average daily air temperature.
    e. Volume of materials represented by test.
2. All test reports shall be signed and sealed by a Professional Engineer licensed in New York state.
3. Non-compliant Test Reports: All test reports indicating non-compliance should be transmitted immediately to all parties on the test report distribution list. Copies shall be on different colored paper.

E. Special Inspection Reports:

1. The Laboratory will transmit 3 copies of the inspection reports to the Architect no later than 2 business days from the date of inspection. The reports will cover location of masonry installation, work progress, weather conditions, variations and deficiencies in quality of contractor's work, changes in dimensions and quantities, errors and corrective methods administered in the field, etc.
2. All inspection reports shall be signed and sealed by a Professional Engineer licensed in the state having jurisdiction over the project.

3.12 REPAIRING, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged or if units do not match adjoining unit. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes and completely fill with mortar. Point-up all joints including corners, openings and adjacent construction to provide a neat uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave ½ panel not cleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning masonry.
3. Protect adjacent precast and non-masonry surfaces from contact with cleaner by covering them with liquid strippable asking agent, polyethylene film or waterproof masking tape.
4. Wet wall Surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised" using the following masonry cleaner:

a. Proprietary acidic cleaner; apply in compliance with directions of acidic cleaner manufacturer.

D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer that ensures unit masonry is without damage and deterioration at time of Substantial Completion.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Retain first paragraph below if clean masonry waste can be used as fill in footing trenches, etc. This diverts some material from waste stream, conserving landfill space and energy required to haul waste away.

C. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Generally retain subparagraph below. If required, increase limit if acid-soil plants are used for foundation plantings.
4. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

3.14 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 04 20 00

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SECTION 04 50 00 – COLD WEATHER MASONRY

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. Work of this Section includes all labor, materials, equipment, and services necessary to complete the work of cold weather masonry as shown on the Drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, work necessary to comply with special requirements for undertaking masonry work specified in other sections when temperatures are below 40 deg. F.

1.3 QUALITY ASSURANCE

A. General: Comply with requirements of Brick Industry Association (BIA), Technical Notes I, Cold and Hot Weather Construction 2006, or as most recently updated; requirements specified in this Section; and requirements specified in individual sections requiring masonry work. In case of conflict, the strictest and most restrictive requirements shall govern.

B. Prior Approval: Do not proceed with masonry work in cold weather unless Architect has specifically approved in writing:
   1. Contractor's Work Proposal for Cold Weather Masonry.
   2. Specific masonry work to be undertaken in each case.

C. Prohibited Materials: Do not add unapproved substances to mortars or grouts.

D. Laws, Code, and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets (MSDS).

B. LEED Submittals (if required by the project):

   1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Work Proposal for Cold Weather Masonry: Proposal for executing masonry work as specified in other sections during cold weather. Include proposed materials, equipment, methods, and procedures to ensure that cold weather masonry work complies with requirements of this Section.

1.5 PROJECT CONDITIONS

A. Protection of Building: Protect building elements, materials, and finishes from damage and from deterioration caused by or resulting from work of this Section. Repair damage to materials and damage to finishes caused by or resulting from cold weather masonry work to Restoration Consultant's satisfaction at no additional cost.

B. Protection from Fire: Take all necessary precautions to prevent fire and spread of fire.
1. Covers: Membranes, insulation blankets, and other materials used to cover masonry shall be flame retardant and fire resistant.
2. Warming Devices: Heating blankets, infrared heaters, and other warming devices shall be UL approved and inspected for damage before use.
3. Open Flame Heaters: No open flame heaters shall be used to protect finished masonry. Heaters used to warm water or sand for mortar or grout shall be well away from building and from flammable substances.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

1. Covers: Install membrane covers, insulation blankets, and other protection to avoid damaging masonry. Do not drill holes in masonry or in any other way damage masonry.

3.2 COLD WEATHER CONSTRUCTION

A. General: Cold weather masonry work using cementitious mortars shall adhere to following requirements for work, performed in ambient temperatures indicated, as well as all published guidelines in Brick Industry Association (BIA), Technical Notes I, Cold and Hot Weather Construction 2006, as updated. In case of conflict, most stringent requirements shall govern. Work shall not be permitted in freezing weather, or when temperature of air or wall is at or below freezing or expected to go below freezing within 48 hours of work without Architect’s prior written approval. No work shall begin when any part of wall or materials in use are frozen or subject to freezing temperatures.

B. Temperature Range 40 deg F to 32 deg F: Heat mixing water or sand to produce mortar between 40 deg F and 120 deg F and maintain above 40 deg F until placed at that temperature.

C. Temperature Range 32 deg F to 20 deg F :

1. Heat mixing water and sand to produce mortar between 40 deg F and 120 deg F. Heat grout materials so grout is maintained and placed at a temperature between 40 deg F and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
2. For work between 25 dcg rand 20 deg F, heat and maintain masonry units above 40 deg F if grouting.

D. Temperature 20 deg F and Below: Heat mixing water and sand to produce mortar between 40 deg F and 120 deg F. Heat grout materials so grout is placed at a temperature between 40 deg F and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosure to heat and maintain temperatures above freezing within enclosure.

3.3 PROTECTION OF COMPLETED MASONRY WORK

A. General: Protect completed masonry work in the following manner. Temperature ranges indicated apply to anticipated minimum night temperatures:

B. Temperature Range 40 deg F to 32 deg F: Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

C. Temperature Range 32 deg F to 20 deg F: Completely cover masonry with weather- resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

D. Temperature 20 deg F and Below: Except as otherwise indicated, maintain masonry temperature above 32 deg F for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps, or other methods proven to be satisfactory. For grouted masonry maintain heated enclosure to 40 deg F for 48 hours.

3.4 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.
1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 04 50 00

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SECTION 04 72 00 – CAST STONE MASONRY

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of new cast stone units as shown on the keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. New cast stone units shall match configuration, dimensions, color, surface texture, and other physical properties, as shown on the drawings.

B. Design Responsibility: Cast stone units shall be designed under the supervision of a Professional Engineer licensed in the State of New York, employed or retained by the Manufacturer, using property data generated from the manufacturer's actual production, in accordance with recommended procedures of the Prestressed Concrete Institute (PCI) and the Cast Stone Institute (CSI).

C. Related Sections:

1. Division 04 "Maintenance and Restoration of Cast Stone Masonry" for installing cast stone units in unit masonry.

D. Definitions:

1. Cast stone: Manufactured units of white and / or gray cements, manufactured of natural sands, carefully selected crush stone or well-graded natural gravels, and mineral coloring pigments to achieve color and appearance matching existing cast stone units to replicate and replace existing cast stone units.
2. Steel: Unless specifically otherwise noted. All references to steel shall mean stainless steel, type 302, 304, 304L, 316, or 316L.
3. Unsatisfactory Cast Stone Units: Unsatisfactory cast stone units shall mean all cast stone units that do not comply with the requirements of this Section for one or more of the following reasons:
    a. Configuration (planes, profiles, and dimensions) does not comply with requirements of this Section and / or does not match the configuration of units to be replaced.
    b. Finish (color, texture, reflectance and other surface characteristics) does not comply with requirements of this Section and / or does not match that of units to be replaced.
    c. Physical and chemical properties do not comply with requirements of this Section, including requirements of referenced Standards.

d. Unit has chipping greater than ¼-inch in any visible location.
e. Unit is damaged or has a defect affecting serviceability.
f. Unit cannot be installed to provide completed masonry restoration complying with requirement of Section 04 72 20 – Maintenance and Restoration of Cast Stone Masonry,

1.3 ACTION SUBMITTALS

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

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, grout composition, and finishes.
2. Recommendations for application and use, and Material Safety Data Sheets (MSDS).

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.
2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.
3. Reinforcing: each type and size. In 6-inch lengths for rods and bars and 12-inch square for mesh and fabric.
4. Anchors and Accessories.

E. Full-Size Samples: For each color, texture and shape of cast stone unit required.

1. Make available for Architect's review at Project site.
2. Make Samples from materials to be used for units used on Project immediately before beginning production of units for Project.
3. Approved Samples may be installed in the Work.

F. Design calculations: Submit complete design calculations for each type of cast stone unit and associated connections, including loads used in design.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364. The completed projects, of at least three, shall be similar in size, material, and scope to work required on this Project and shall have been exposed to the weather for at least ten years.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364**,** including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.
2. Testing for Efflorescence: Include results of test for efflorescence with the mix designs.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Award the work of cast stone units to a recognized and reputable manufacturer regularly engaged in the manufacture of cast stone units with a minimum of ten years' continuous operation and with adequate experience and facilities to furnish the quantity and quality of cast stone required for the Project without delaying the progress of the Work. The manufacturer's products shall have been previously used and exposed to the weather with satisfactory results.

1. Manufacturer of cast stone shall be a current member of the Cast Stone Institute.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. 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.

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

F. Referenced Standards: Work of this Section shall comply with applicable requirements and recommendations of latest editions of the documents listed herein, except as modified by more stringent requirements of the Contract Documents and of applicable laws, codes, and regulations of authorities having jurisdiction. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract unless specifically indicated otherwise in Contract Documents. Provide a reference copy of each of the following standards at shop and at Project site during all periods when work of this Section is being performed in each location. In each case in which there is a conflict between requirements of referenced standards; requirements of laws, codes, and regulations; and requirements of this Section, the most stringent or restrictive requirement shall govern.

1. ASTM International (ASTM)

a. ASTM A 580, Standard Specification for Stainless Steel Wire.
b. ASTM A 666, Standard Specification for Annealed or Cold-Workcd Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
c. ASTM C 33, Standard Specification for Concrete Aggregates.
d. ASTM C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
e. ASTM C 150, Standard Specification for Portland Cement.
f. ASTM C 173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.
g. ASTM C 260, Standard Specification for Air-Entrained Admixtures for Concrete.

h. ASTM C 494, Standard Specification for Chemical Admixtures for Concrete.
i. ASTM C 618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concretc.
j. ASTM C 642, Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.
k. ASTM C 666, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
l. ASTM C 979, Standard Specification for Coloring Pigments for Integrally Pigmented Concrete.
m. ASTM C I 194, Standard Test Method for Compressive Strength of Architectural Cast Stone.
n. ASTM C 1195, Standard Test Method for Absorption of Architectural Cast Stone.
o. ASTM C 1364, Standard Specification for Architectural Cast Stone.

2. American Welding Society (A WS) Code: Dl. I, Structural Welding.
3. Cast Stone Institute (CSI): Cast Stone Institute Technical Manual.
4. Precast Concrete Institute (PCI): PCI MNL I 17, Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

G. Access for observation and Approvals: Provide Architect access on a continuing basis to locations where work of this Section is ongoing and where work has been completed to allow for observation and approvals.

H. Knowledge of Site and Project Conditions: Before submitting bid, Bidders shall make themselves thoroughly familiar with the Drawings and Specifications, with the scope of this Project, and with all conditions at the Project site relating to requirements of this Section and limitations under which the work will be performed and shall determine or verify dimensions. Submission of a bid shall be considered conclusive evidence that Contractor is thoroughly familiar with Project requirements and site conditions and limitations.

I. Sampling, Inspection, and Testing: Comprehensive sampling, inspection, and testing procedures as specified in Articles "Sampling and Testing for Physical and Chemical Properties," and "Testing for Efflorescence," below. Standards for materials are listed in Pmt 2 of this Section.

J. Inspection on Delivery: Architect will examine delivered cast stone units within one week of delivery and shall have right to reject unsatisfactory cast stone units and request new units complying with requirements of this Section at no additional cost and to select units for testing and reject all units from batches where units tested fail to comply with requirements of this Section.

1. Failure to reject units on delivery shall in no way relieve Contractor from replacing units that are deteriorated or damaged in completed work at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

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, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
3. The Contractor shall be responsible for all chipping, spalling, cracking, and other damage to the units after delivery to Project site.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

E. Examination of Cast Stone Units: Examination of cast stone delivered to site for profile and dimensional tolerances and for surface color, texture, and finish shall be in accordance with generally recognized industry standards, but such standards shall be superseded by the tolerances and appearance characteristics required to provide installed cast stone units matching adjacent cast stone units.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

1. 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 cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

C. Field Conditions: If field conditions require adjustments in the fabrication of cast stone units that will result in cast stone units that do not comply fully with all requirements specified herein, notify Architect before proceeding with the work. Make adjustments only after Architect has approved all deviations from Contract Documents in writing.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: White and / or grey Portland cement complying with ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Aggregates:

1. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

2. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.
3. For surfaces exposed to view, select aggregates as required to achieve cast stone units matching color of cleaned original units being replicated with no addition of pigment or with minimal addition of pigment.

D. Color Pigment: Natural and synthetic inorganic iron oxide pigments complying with requirements of ASTM C 979, guaranteed by pigment manufacturer to be lightfast and lime-proof, and with a history of use in cast stone and mortal' with successful in-service performance.

E. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: Comply with ASTM C 260.
4. Water-Reducing Admixture: Complying with ASTM C 494 and without adverse effect on color or on surface reflectance and appearance.
5. Water: Clean, potable, and free of substances that might adversely affect properties (including color), setting, strength, or durability of cast stone units.

F. Reinforcement: Reinforcing Rods and Mesh: All reinforcing for cast stone units shall be stainless steel, ASTM A 167, Type 302, 304, 304L, 316, or 3l6L. Reinforcing that is welded shall be ASTM A 167, Type 316L, stainless steel.

G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

A. General: Units of sizes and shapes required to match original units and with reinforcing to provide sound units and as shown on approved shop drawings. Units shall comply with physical properties specified below and shall have color and finish matching that of approved samples. Limit ingredients to those specified in this Section.

B. Regional Materials: Cast stone units shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

C. Provide cast stone units complying with ASTM C 1364 in vibrant dry tamp or wet-cast method matching production method of original units.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

D. Reinforcement: Reinforce cast stone units with stainless steel wire mesh, stainless steel welded wire fabric, and stainless steel rods as required for propel' structural performance of in place units, as required to allow for temperature changes, and with additional reinforcement as may be required to prevent damage and deterioration during handling, transportation, and installation. Provide each unit with a minimum reinforcement amounting to 1/4 of I percent of

sectional area of units. For cast stone units greater than 12 inches in any dimension, provide steel meeting above requirement in both directions.

1. Cover: Provide cover of twice the diameter of bar or wire or 3/4-inch, whichever is greater. Support reinforcing to avoid weakening units and evidence of reinforcing supports on all surfaces exposed after installation.

E. Physical Properties: Cast stone units shall have the following physical properties when tested in accordance with requirements of American Concrete Institute specifications 704-44 and with requirements of indicated ASTM specifications. Reject all units from batch where tested units do not comply. Replace rejected units with new units complying with requirements of this Section at no additional cost.
1. Specific Gravity: 2.60, unless a less dense mix is proven to be durable by actual freezing and thawing tests and approved in writing by Restoration Consultant.
2. Compressive Strength:
   a. ASTM C 1194: 6500 psi minimum for products at 28 days; or,
   b. ASTM C 39: 5000 psi minimum for products at 28 days.
3. Absorption: ASTM C 1195 or ASTM C 642: Six percent maximum for products at 28 days.

F. Surface Finish: All visible surfaces of installed cast stone units shall be free from surface defects and shall be finished to match the color, texture, and surface of control sample.

1. No pin or air holes will be permitted.
2. Surfaces shall be face of joint marks, "grain," and other obvious defects.

G. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain 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.

H. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

I. Cure units as follows: Cure units by approved methods to ensure required properties and to prevent unevenness of color.

1. Initial Curing: Immediately after casting, cure cast stone units in a totally enclosed room under a dense fog of water spray at 95 percent relative humidity for 24 hours to ensure sufficient strength for removing units from forms.

2. Final Curing: After initial curing, remove units from forms and provide for final curing in accordance with manufacturer's standard curing practice and as specified below.

   a. Moist Curing: Keep units continuously wet and at a temperature between 60 deg F and 120 deg F for a minimum of 7 days.

   b. Curing Admixture: Use acrylic thermoplastic copolymer dispersion as a curing admixture. Use only copolymers shown to eliminate need for moist curing through published independent laboratory test data and approved by Architect.

J. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

K. Colors and Textures: Match control sample.

2.3 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.

   1. Include one test for resistance to freezing and thawing.

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 work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Install cast stone units as work of Section 04 72 20 Maintenance and Restoration of Cast Stone Masonry.

3.2 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.
   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 04 72 00

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SECTION 05 12 00 – STRUCTURAL STEEL FRAMING
PART 1 - GENERAL

1.1 SCOPE

A. The extent of Structural Steel is as shown on the Working Drawings and as herein specified. The General and Supplementary Conditions and Division 1 Specification sections apply to work of this Section.

B. Work included but not limited to:

1. Structural steel columns, girders, and beams; both rolled and built-up sections. Trusses and plate girders, if any.
2. Shop and field connections.
3. Lintels shown on structural drawings.
4. Supporting and attachment steel required by other trades, as shown on structural drawings.
5. Holes for attachment of other trades, if information is furnished before final approval of shop drawings.
6. Shear stud connectors.
7. Surface preparation, shop painting, and field touch-up as specified herein.
8. Field measure existing conditions affecting safety, fitting up, and connections of new steel to existing structure.

1.2 GENERAL PROVISIONS

A. Standard Specifications and Codes issued by professional organizations and governmental agencies are specified hereinafter by basic designations and only the applicable editions and revisions thereto shall apply to the work of this Section.

B. Applicable Codes, Specifications, and Guides as listed below, but not limited to:

1. The 2020 Building Code of New York State.
2. "Specification for Structural Steel Buildings" issued by the American Institute of Steel Construction (AISC).
3. "Specification for Structural Joints Using ASTM A325 or A490 Bolts" issued by the AISC.
4. "Code of Standard Practice for Steel Buildings and Bridges" issued by the AISC.
5. AWS D1.1/D1.1M "Structural Welding Code – Steel" issued by the American Welding Society (AWS).
6. SSPC Painting Manual Volume 2 "Systems and Specifications", issued by the Steel Structures Painting Council (SSPC).

C. In case of any conflict between the referenced standards and these specifications, the one having more stringent requirements shall prevail.

D. Coordination - Carry out the work of this Section in coordination and cooperation with contiguous work of other trades and/or Contracts involved.

E. Testing and Special Inspections:

1. Testing and special inspection of structural steel fabrication and erection will be provided by the licensed testing and inspection laboratory/agency (Laboratory), hired and paid directly by the Owner, under a separate contract. The Laboratory shall be acceptable to the Building Department and Structural Engineer of Record. Alternatively, at Owner's discretion, the Structural Engineer of Record, if qualified, shall be hired to perform the special inspection services and act as Laboratory.
2. The inspection of welds will include radiographic, magnetic particle, dye penetrant, ultrasonic, and visual techniques.
3. The Contractor shall cooperate fully with the Laboratory and provide to the Laboratory, or the Owner's agent, free of additional charge, the following:

    a. A complete set of approved erection and shop drawings, as well as other documents described under paragraphs "Reports" and "Product Data" of this chapter.
    b. All necessary test pieces for testing, as required by the Laboratory.
    c. Material and shipping bills, order sheets and cutting lists.
    d. Information regarding time of rolling and shipment of steel to fabrication shops. A minimum notice of three (3) business days shall be given to the Laboratory to allow for timely response.
    e. Full and ample means and assistance for testing all materials including use of testing equipment and proper facilities for inspecting the work in the shop and field.

4. The testing and inspection shall be performed in such a way that fabrication and erection are not delayed and as follows:

    a. The Laboratory shall perform all tests and inspections as required by all applicable Building Codes. All the tests and inspections shall be made as indicated in the Contract Documents.
    b. Radiographic inspection shall be in accordance with Section 6, Part E of the AWS D1.1 "Structural Welding Code – Steel." One copy of each film will be sent to the Architect.
    c. Ultrasonic inspection shall be in accordance with Section 6, Part F of the AWS D1.1 "Structural Welding Code-Steel."
    d. Shop welds shall be inspected in the shop before the work is painted or approved for shipment.
    e. All tests and inspections of high strength bolted connections shall be as required by AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
    f. Under-tensioned A325 or A490 bolts shall be further tightened until they meet acceptable criteria for tension.
    g. Under-tensioned F1852 twist-off bolts, evidenced by shearing of the "break-neck" prior to minimum required clamp force, shall be replaced with new twist-off bolts. Lubrication of twist-off bolts shall not be permitted unless performed by the original manufacturer.
    h. In case multiple defects have been detected, the extent of inspection and testing shall be increased as much as necessary to assure that the full extent of the defects have been found and to assure that similar defects do not occur under similar circumstances in the future. The cost of additional inspection and testing shall be borne by the Contractor.

5. Special Inspection Reports:

    a. The Laboratory will transmit inspection reports to the Architect no later than 2 business days from the date of inspection. The reports will cover description of elements inspected, material verifications, work progress, weather conditions if applicable,

variations and deficiencies in quality of Contractor's work, changes in dimensions and quantities, errors and corrective methods administered in the field, etc.

b. Non-compliant test reports: All test reports indicating non-compliance shall be sent immediately to all parties on the test report distribution list under a separate title.

6. These tests and inspections are required primarily for the protection of the Owner and to ensure specified quality of construction. The Contractor shall assume full and sole responsibility for producing the specified results and for complying fully with the Building Code and rules and regulations of all jurisdictional authorities. No relief will be afforded because of any failure to comply with these requirements. If any inspections reveal cause for rejection of work performed, correct or replace such defective or unacceptable work without extra cost to the Owner.

1.3 SUBMITTALS

A. General: Submit shop drawings and other submittals for the Architect's approval in accordance with the provisions of the project General Conditions, as well as the drawings and specifications, including Section 01 33 00 – Submittal Procedures.

1. The Contractor shall be responsible for identifying, preparing and delivering all submittals required by the contract documents in a timely manner. All submittals shall be delivered gradually so as to avoid submission of large number of shop drawings and other documents not allowing the Architect's and Engineer's timely review.
2. The Contractor shall demonstrate competency in preparing and delivering the required submittals and shall recognize the appropriate time and sequence related to the process of preparation, submission, and review of submittals.
3. The Contractor shall furnish the Architect and the Engineer a Schedule of Submittals indicating the respective dates of submission of each of them, and expected date of fabrication and installation. Such schedule shall indicate submittals critical to the construction progress schedule. The Architect and the Engineer shall review the Schedule of Submittals and coordinate with the Contractor. Mutually agreed on schedule shall serve as a guideline to the Contractor's submittals. In case of substantial deviations from the schedule, the Engineer shall not be expected to review more than five (5) erection drawings or shop drawings in any one business day.
4. The submittal review time shall be understood as beginning on the first business day following the receipt of the submittals by the Engineer and ending on the day when the submittals have been returned to the Contractor by the Architect. Every effort shall be made by the Engineer to review the submittals so that the review time for any single document does not exceed 14 calendar days. However, the Engineer shall not be required to review any submitted document in less than 5 business days. If more expeditious review is requested and agreed to by the Engineer, the Engineer's costs associated with such expedited review of any submittal shall be withheld from the monies due the Contractor by the Owner and paid to the Engineer.

B. Reports and Procedures: Submit the following to the Architect prior to the ordering and fabrication of any steel:

1. Mill test reports for each type of steel specified in the contract documents. The test reports shall be obtained from the mill producing the steel certifying that the furnished steel meets the minimum requirements for structural steel, as to physical properties, inspections, markings

and tests. If required, these manufacturer's reports shall be filed with the Department of Buildings by the Contractor.

2. Pre-qualified and other welding procedures in form as prescribed in “Structural Welding Code-Steel.”
3. Certified fastener test reports for each lot of high strength structural fasteners, including A325 and A490 bolts, F436 washers, F959 DTI’s, A563 nuts, and F1852 twist-off bolts.
4. Any additional reports, affidavits or other requirements of the Department of Buildings.

C. Product Data: Submit product data or manufacturer’s specifications and installation instructions for the following:

1. High strength bolts (each type), including nuts and washers.

    a. Include Direct Tension Indicators.

2. Structural steel paint.
3. Low-shrinkage grout.

D. Shop Drawings: Submit Shop Drawings for the Architect's approval in accordance with the provisions of Section 01 33 00 and other contract documents. The Contractor shall engage a licensed professional engineer to prepare the shop drawings. The submittals shall include the following:

1. Erection drawings: Submit for approval as early as possible. These drawings shall be signed and sealed by the Contractor’s engineer at each submission.
2. Standard and special details: Submit standard detail shop drawings, including connection details, for approval as early as possible. Do not submit detailed piece shop drawings until standard detail shop drawings and erection drawings have been approved.
3. Index sheets: Furnish with beam, girder, and column detail drawings when these details are submitted.
4. Shop drawings: Indicate type, size, and dimensions of all welds. Do not perform any work in the shop or field except in accordance with approved shop drawings.
5. Shop drawings shall include details of the surface preparation and shop painting.
6. The details shall be made in such a way as to avoid having steel connections, bracing, etc. interfere with architectural details or in any way reduce the areas of shafts, openings, clearances, etc.
7. Electronic submission of shop drawings: Shop drawings submitted electronically shall follow proper channels of submission as established with the Owner and the design team. In addition, the provisions of the General Conditions, as well as the drawings and specifications, shall be followed as established for hard copy submissions.

    a. Shop drawings shall be submitted under a separate cover, including the title block and clear identification of the project on each drawing. Provide all other pertinent information and include the Contractor’s review comments and review status on the electronic submission.
    b. Shop drawings submitted electronically shall be prepared in a standard format agreed to in advance by the Architect. All submittals must be capable of being scanned electronically for filing on a computer.
    c. Reviewed submittals shall be returned in PDF electronic format for the Contractor’s printing and distribution.

E. Calculations: Submit calculations for the design of all members and connections if required per structural drawings. Calculations shall bear the seal of a Professional Engineer registered in the State of New York. Calculations shall be submitted for reference and record only, and shall not be returned by GACE.

1.4 ANCHOR BOLTS AND TEMPLATES

A. The Contractor shall furnish required anchor bolts and templates for same to other trades for installation by others.

1.5 ARCHITECTURAL STEEL

A. Unless otherwise called for, Architectural Steel shall be defined as all structural steel which is exposed to view in the finished building.

1.6 PRE-CONSTRUCTION MEETING

A. Prior to the start of work, a meeting with the Owner, the Architect, the Engineer, the General Contractor, the Structural Steel Contractor, the Owner's Testing and Special Inspection Laboratory, and any other subcontractors whose work requires coordination with this work shall be conducted. Review methods and sequence of fabrication and erection, quality control requirements, coordination of the work with other trades, special details and conditions, and other pertinent topics as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: The specifications of the American Society for Testing and Materials (ASTM), latest edition, shall apply to any and all for which an ASTM Standard has been established, unless otherwise specified below. The manufacturer or supplier of each material shall certify that his material conforms to the applicable ASTM specification.

B. Structural steel shall conform to the following unless otherwise noted:

1. Channels, S shapes, angles, plates, and bars – ASTM A36.
2. Pipe – ASTM A53, Grade B.
3. HSS shapes – ASTM A500, Grade B.
4. HP shapes – ASTM A572, Grade 50.
5. All others – ASTM A992, Grade 50.

C. High strength bolts:

1. Bolts: Use ASTM A325 or A490 bolts manufactured by Infasco or approved equal. ASTM F1852 "twist-off" type tension control bolts produced by manufacturer may be used if approved by the Engineer of Record.
2. Hardened washers: Use ASTM F436 washers manufactured by Infasco or approved equal.

3. Direct Tension Indicators: Use ASTM F959 washers manufactured by TurnaSure LLC, Beth-Fast, or approved equal.
4. Heavy hex nuts: Use only ASTM A563 heavy hex nuts manufactured by Infasco or Unitite.
5. Galvanized bolts: Where shown or noted as galvanized, bolts nuts and washers shall be hot-dip galvanized in compliance with ASTM A153. Nuts shall be lubricated in accordance with ASTM A563. Rotational capacity tests shall be performed on each assembly lot.

D. Filler metal:

1. Electrodes shall be selected as required for matching base metal as specified in AWS "Structural Welding Code – Steel."
2. The electrodes and flux used for submerged arc welding shall be provided by the same manufacturer. The flux shall be free of contamination from dirt, mill scale, and other foreign material. Fused flux used in welding shall not be reused.

E. Shear stud connectors: Use ASTM A108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications and complying with "Structural Welding Code – Steel." Type and sizes shall be as shown on contract documents.

F. Anchor bolts: Use ASTM F1554, Grade 36 anchor rods unless otherwise noted.

G. Paint for shop coat, except as otherwise required for compatibility with finish paints as specified in Section 099000, shall be "Azeron H.S. Primer No. 88-555" by Tnemec or a comparable suitable product by DuPont or Glidden.

H. Shrinkage resistant grout: Pre-mixed, nonmetallic, noncorrosive, nonstaining, shrinkage resistant product containing selected silica sands, Portland cement, shrinkage reducing agents, etc. Provide one of the following, subject to approval by the Engineer of Record:

1. "Five Star Grout" by Five Star Products, Inc.
2. "Masterflow 713" by BASF Corp.

PART 3 - EXECUTION

3.1 DESIGN AND WORKMANSHIP

A. Unless otherwise specified or indicated, the design, fabrication, and erection of steel work included in this Contract shall conform to the "Specification for Structural Steel Buildings" by the American Institute of Steel Construction (AISC) and the regulations of the Building Code, including all amendments made thereto, whichever is the more restrictive.

B. Existing conditions:

1. Visit the project site and advise the Architect of any discrepancy or conflict. Field verify existing construction requirements, existing conditions, restrictions, and clearances which may affect structural steel erection.
2. Examine the substrates, adjoining construction, and the conditions under which the work is to be installed. Do not proceed until unsuitable conditions have been corrected. Consider all conditions which will affect satisfactory erection of the structural steel.

C. Erection:

1. Check the alignment and elevations of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify and obtain Structural Engineer of Record's approval of methods proposed for correcting errors prior to proceeding with corrections.
2. Drift pins may be used only to align the erected parts. They shall not be used in such manner as to distort or damage the steel.
3. Make all necessary provisions for temporary shoring and bracing with connections of sufficient strength to sustain the imposed loads and for completion of erection where structural members are temporarily left out for erection at a later date.
4. Base and bearing plates:

    a. Clean concrete and masonry bearing surfaces of deleterious materials and roughen as necessary to provide adequate bond. Clean bottom surface of base and bearing plates immediately prior to erection.
    b. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
    c. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims. Cut off protruding parts flush with edges of base or bearing plates prior to packing with grout.
    d. Pack grout solidly between bearing surfaces and steel or plates. Ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow grout to cure as per manufacturer's specifications.

D. Connections – General:

1. Not less than 3/4" diameter bolts and/or not less than 1/4" welds shall be used, unless otherwise noted on the drawings.
2. The shear connections of all beams and girders shall be adequate to provide for the reactions indicated on structural drawings or, if not indicated, for the shear capacity of the beam. All other connections shall be designed for the full capacity of the members unless specifically noted on the structural drawings.
3. Shop connections shall be high strength bolted or welded, at the Contractor's option, unless shown otherwise.
4. One-sided or other types of eccentric connections will be permitted where arranged to minimize torsion.
5. Knife connections will not be permitted unless specifically requested by a Contractor and approved by the Structural Engineer of Record prior to the shop drawing approval. Knife connections are understood as where two angles or plates are connected to the main framing member and a secondary member (beam, diagonal bracing, etc.) fits ("knifes") in between. The Contractor's bids shall be based on the knife connections not allowed. Specific knife connection details shall be submitted for approval at the time of typical detail and erection plan submission. The details shall be accompanied by calculations, prepared, signed and sealed by a professional engineer licensed in the State of New York. Calculations shall demonstrate that welds are not overstressed due to the secondary stresses caused by bolt tightening, prying action, etc.
6. Connections shall be made to clear architectural finishes.
7. Secondary members such as lintels requiring accurate alignments shall be detailed with slotted holes and/or washers for truing up steel as required.

E. Acetylene cutting of structural steel in the field shall not be done except with the written consent of the Architect. The use of acetylene cut holes for riveted or bolted connections will not be permitted; violation of this clause will be sufficient cause for rejection of any pieces in which acetylene-cut holes exist.

F. Holes for anchors: Supports and attachments required in connection with the work of other trades will be furnished by others unless specifically called for on the drawings or in this Specification. The Contractor, however, shall, as a part of his contract, provide any holes in structural steel work necessary for their installation, provided correct information regarding location of such holes is furnished not later than the date when shop drawings are finally approved.

3.2 HIGH STRENGTH BOLTING

A. High strength bolts shall be installed as per “Specification for Structural Joints using ASTM A325 or A490 Bolts.”

B. The Owner's Inspector will approve the procedure for calibration of wrenches and installation of bolts. Periodic checks will be made in the field with a torque wrench to verify the minimum torque requirements.

3.3 WELDING

A. Materials and workmanship:

1. Welding shall be done in accordance with the Building Department and Fire Department regulations and the requirements of AWS “Structural Welding Code – Steel,” referenced herein.
2. Peening: Used only after permission for its use is obtained from the Architect.
3. Protection, storage, and drying of welding electrodes shall be as specified in AWS “Structural Welding Code – Steel.”
4. Groove welds shall be complete penetration welds unless otherwise shown.

B. Welders and welding operators:

1. Welders and welding operators to be employed for this work must be qualified as prescribed in AWS “Structural Welding Code – Steel.”
2. All costs for qualifying welders will be borne by the Contractor.

3.4 SURFACE PREPARATION AND PAINTING

A. All steel shall be cleaned in accordance with SSPC-SP2 “Hand Tool Cleaning”, except as specified below for “Architectural Steel”.

B. After fabrication, steel shall receive a shop coat of paint to provide 2.0 - 4.0 mils dry film thickness, except for the following:

1. Members to be encased in concrete.
2. Areas within 2" of field welds.
3. Contact surfaces of high strength bolted connections.
4. Surfaces receiving shear studs, rebar dowels, etc.

5. Milled surfaces (protect with an approved rust-inhibitive coating readily removable prior to erection, or of a type not requiring removal).
6. Members which will receive cementitious fireproofing.
7. Members to be galvanized.

C. After erection all damaged areas in the shop coat, loosened scale, rust, exposed surfaces of bolts, nuts and washers, and all field welds and unpainted areas shall be cleaned to the same standards as for the shop coat and spot painted with the same paint used for the shop coat, at same film thickness.

D. Steel surfaces which will be inaccessible after erection and are not concrete encased shall be painted prior to erection with an additional coat of shop paint.

E. “Architectural Steel”

1. Surface preparation shall be SSPC-SP6 “Commercial Metal Blast Cleaning.”
2. Shop coat shall be Tnemec 37-77 “Chem-Prime H.S.” alkyd-phenolic Universal Primer applied at 2.0-3.5 mils dry film thickness, or approved equal, compatible with finish coat specified.
3. Bolts, nuts, and washers shall be hot-dip galvanized in compliance with ASTM A153.

3.5 SURVEY

A. Perform survey of actual column locations and elevations immediately upon the completion of every level of steel and immediately submit same to the Architect. Should column locations vary beyond the allowable tolerances, take necessary corrective measures prior to proceeding to next level and modify details and erection procedure as required.

END OF SECTION 05 12 00

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SECTION 05 21 00 – STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SCOPE

A. The extent of Steel Joists and Joist Girders is as shown on the Working Drawings and as herein specified. The General and Supplementary Conditions and Division 1 Specification sections apply to work of this Section.

B. Work included but not limited to:

1. Steel joists and joist girders, including those requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."
2. Bridging.
3. Joist accessories.
4. Furnish anchor bolts for installation under other sections.

1.2 GENERAL PROVISIONS

A. Standard Specifications and Codes issued by professional organizations and governmental agencies are specified hereinafter by basic designations and only the applicable editions and revisions thereto shall apply to the work of this Section.

B. Applicable Codes, Specifications, and Guides as listed below, but not limited to:

1. The 2020 Building Code of New York State.
2. "Code of Standard Practice for Steel Joists and Joist Girders" and "Standard Specification for K-Series, LH-Series, and DLH-Series Open Web Steel Joists and for Joist Girders" as adopted by the Steel Joist Institute.
3. AWS D1.1/D1.1M "Structural Welding Code – Steel" issued by the American Welding Society (AWS).
4. SSPC Painting Manual Volume 2 "Systems and Specifications", issued by the Steel Structures Painting Council (SSPC).

C. In case of any conflict between the referenced standards and these specifications, the one having more stringent requirements shall prevail.

D. Coordination - Carry out the work of this Section in coordination and cooperation with contiguous work of other trades and/or Contracts involved.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load vertical deflections no greater than L/360 of the span.

1.4 SUBMITTALS

A. General: Submit shop drawings and other submittals for the Architect's approval in accordance with the provisions of the project General Conditions, as well as the drawings and specifications, including Section 01 33 00 – Submittal Procedures.

1. The Contractor shall be responsible for identifying, preparing and delivering all submittals required by the contract documents in a timely manner. All submittals shall be delivered gradually so as to avoid submission of large number of shop drawings and other documents not allowing the Architect's and Engineer's timely review.
2. The Contractor shall demonstrate competency in preparing and delivering the required submittals and shall recognize the appropriate time and sequence related to the process of preparation, submission, and review of submittals.
3. The Contractor shall furnish the Architect and the Engineer a Schedule of Submittals indicating the respective dates of submission of each of them, and expected date of fabrication and installation. Such schedule shall indicate submittals critical to the construction progress schedule. The Architect and the Engineer shall review the Schedule of Submittals and coordinate with the Contractor. Mutually agreed on schedule shall serve as a guideline to the Contractor's submittals. In case of substantial deviations from the schedule, the Engineer shall not be expected to review more than five (5) erection drawings or shop drawings in any one business day.
4. The submittal review time shall be understood as beginning on the first business day following the receipt of the submittals by the Engineer and ending on the day when the submittals have been returned to the Contractor by the Architect. Every effort shall be made by the Engineer to review the submittals so that the review time for any single document does not exceed 14 calendar days. However, the Engineer shall not be required to review any submitted document in less than 5 business days. If more expeditious review is requested and agreed to by the Engineer, the Engineer's costs associated with such expedited review of any submittal shall be withheld from the monies due the Contractor by the Owner and paid to the Engineer.

B. Product Data: For each type of joist, accessory, and product indicated.

C. Shop Drawings: Show layout, designation, number, type location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Provide templates or location drawings for installation of anchorage devices and bearing plates in other construction materials.

D. Welding certificates.

E. Calculations: Submit design calculations for all joists showing complete geometry and member sizes, including web and chord member splices to verify compliance with these specifications, contract drawings, and SJI specifications. Calculations shall bear the seal of a Professional Engineer registered in the State of New York. Calculations shall be submitted for reference and record only and shall not be returned by GACE.

F. Electronic submission of shop drawings: Shop drawings submitted electronically shall follow proper channels of submission as established with the Owner and the design team. In addition, the provisions of the General Conditions, as well as the drawings and specifications, shall be followed as established for hard copy submissions.

1. Shop drawings shall be submitted under a separate cover, including the title block and clear identification of the project on each drawing. Provide all other pertinent information and include the Contractor's review comments and review status on the electronic submission.
2. Shop drawings submitted electronically shall be prepared in a standard format agreed to in advance by the Architect. All submittals must be capable of being scanned electronically for filing on a computer.
3. Reviewed submittals shall be returned in PDF electronic format for the Contractor's printing and distribution.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Quality procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" (SJI K-1.1) for web and steel-angle chord members.

B. The steel used in the manufacture of joists shall conform to one of the following ASTM Specifications:

1. Carbon Structural Steel, ASTM A36/A36M.
2. High-Strength Low-Alloy Structural Steel, ASTM A242/A242M.
3. Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, ASTM A500/A500M.
4. High-Strength Carbon-Manganese Steel of Structural Quality, ASTM A529/A529M.

5. High-Strength Lowe-Alloy Columbium-Vanadium Structural Steel, ASTM A572/A572M.
6. High-Strength Low-Alloy Structural Steel up to 50 ksi [345 MPa] Minimum Yield Point with Atmospheric Corrosion Resistance, ASTM A588/A588M.
7. Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance, ASTM A606/A606M.
8. Structural Steel Shapes, ASTM A992/A992M.
9. Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable, ASTM A1008/A1008M.
10. Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra High Strength, ASTM A1011/A1011M.

C. Steel Bearing Plates: ASTM A36.

D. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.

E. High-Strength Threaded Fasteners: ASTM A 325 heavy hexagon structural bolts with nuts and hardened washers.

F. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer’s standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS AND JOIST GIRDERS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications.”

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications.”

G. Camber joists according to SJI's "Specifications.”

H. Bearing ends of steel joists shall be so proportioned that the unit pressure per square inch shall not exceed 250 pounds for solid masonry, or 600 pounds for poured concrete. Where steel joists rest on steel supports, length of bearing shall be according to the Steel Joists Institute.

I. Equip bearing ends of joists with manufacturer's standard bevelled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Supply ceiling extensions where ceiling is attached directly to bar joists, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

C. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing 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 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Steel joists shall be erected in accordance with the requirements of the Steel Joist Institute.

C. Bearing Plates: Furnish steel bearing plates to be built into concrete and masonry construction.

D. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 ANCHORING JOISTS

A. Anchor steel joists to supporting steel framework with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used. Joists on column lines shall be field bolted with high-strength threaded fasteners installed snug tight.

B. Joists where shown with bottom chord extensions shall not have the bottom chords connected to the supporting members until the full dead load is applied.

C. Anchor joists resting on masonry or concrete to steel bearing plates embedded therein with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used.

3.4 HANGING FROM STEEL JOISTS

A. The hanging of equipment, pipes, etc. shall be done from the top chords of members joists at panel points. Ceilings, if any, shall be hung from bottom chords at panel points.

3.5 FIELD QUALITY CONTROL

A. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

B. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Touch-up Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPCSP 3.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05 21 00

SECTION 05 31 00 – STEEL DECKING

PART 1 - GENERAL

1.1 SCOPE

A. The extent of Steel Decking is as shown on the Working Drawings and as herein specified. The General and Supplementary Conditions and Division 1 Specification sections apply to work of this Section.

B. Work included but not limited to:

1. Steel deck shown on Drawings, including required shoring.
2. Steel flashing between steel deck and adjacent construction, and all other miscellaneous items and accessories required for the completion of steel deck work.
3. Cutting and reinforcing of openings in steel deck.

1.2 GENERAL PROVISIONS

A. Standard Specifications and Codes issued by professional organizations and governmental agencies are specified hereinafter by basic designations and only the applicable editions and revisions thereto shall apply to the work of this Section.

B. Applicable Codes, Specifications, and Guides as listed below, but not limited to:

1. The 2020 Building Code of New York State.
2. “North American Specification for the Design of Cold-Formed Steel Structural Members” issued by the American Iron and Steel Institute (AISI).
3. AWS D1.1/D1.1M “Structural Welding Code – Steel” issued by the American Welding Society (AWS).
4. “Design Manual for Composite Decks, Form Decks, and Roof Decks” issued by the Steel Deck Institute (SDI).
5. ANSI/SDI-RD1.0 “Standard for Steel Roof Deck” issued by the Steel Deck Institute (SDI).

C. In case of any conflict between the referenced standards and these specifications, the one having more stringent requirements shall prevail.

D. Coordination - Carry out the work of this Section in coordination and cooperation with contiguous work of other trades and/or Contracts involved.

E. Steel deck receiving concrete topping or fill shall sustain the wet concrete weight with a maximum deflection of 1/240 of span.

F. Unless otherwise noted, steel deck receiving concrete topping or fill shall act compositely with the concrete.

G. Furnish all tests, reports, and affidavits required by the Department of Buildings.

1.3 SUBMITTALS

A. General: Submit shop drawings and other submittals for the Architect's approval in accordance with the provisions of the project General Conditions, as well as the drawings and specifications, including Section 01 33 00 – Submittal Procedures.

1. The Contractor shall be responsible for identifying, preparing and delivering all submittals required by the contract documents in a timely manner. All submittals shall be delivered gradually so as to avoid submission of large number of shop drawings and other documents not allowing the Architect's and Engineer's timely review.
2. The Contractor shall demonstrate competency in preparing and delivering the required submittals and shall recognize the appropriate time and sequence related to the process of preparation, submission, and review of submittals.
3. The Contractor shall furnish the Architect and the Engineer a Schedule of Submittals indicating the respective dates of submission of each of them, and expected date of fabrication and installation. Such schedule shall indicate submittals critical to the construction progress schedule. The Architect and the Engineer shall review the Schedule of Submittals and coordinate with the Contractor. Mutually agreed on schedule shall serve as a guideline to the Contractor's submittals.
4. The submittal review time shall be understood as beginning on the first business day following the receipt of the submittals by the Engineer and ending on the day when the submittals have been returned to the Contractor by the Architect. Every effort shall be made by the Engineer to review the submittals so that the review time for any single document does not exceed 14 calendar days. However, the Engineer shall not be required to review any submitted document in less than 5 business days. If more expeditious review is requested and agreed to by the Engineer, the Engineer's costs associated with such expedited review of any submittal shall be withheld from the monies due the Contractor by the Owner and paid to the Engineer.

B. Shop Drawings: Submit Shop Drawings for the Architect's approval in accordance with the provisions of Section 01 33 00 and other contract documents. The Contractor shall engage a licensed professional engineer to prepare the shop drawings. The submittals shall include the following:

1. Complete erection layouts showing pieces related to supporting walls, beams, and other members.
2. Marks, dimensions, gages, and types of all pieces.
3. Method of fastening steel deck and accessories, including installation instructions.
4. Openings through steel deck dimensioned and reinforced as required.
5. Surface finishes.

C. Tests of weight of zinc coating shall conform to ASTM A90. Test panels shall be not less than 3 inches x 6 inches cut from fabricated deck units equivalent to those to be furnished. A sample of the zinc-coated accessories shall be tested by the same method. Contractor shall submit copies of test reports to Architect for approval.

D. Electronic submission of shop drawings: Shop drawings submitted electronically shall follow proper channels of submission as established with the Owner and the design team. In addition, the provisions of the General Conditions, as well as the drawings and specifications, shall be followed as established for hard copy submissions.

1. Shop drawings shall be submitted under a separate cover, including the title block and clear identification of the project on each drawing. Provide all other pertinent information and include the Contractor's review comments and review status on the electronic submission.
2. Shop drawings submitted electronically shall be prepared in a standard format agreed to in advance by the Architect. All submittals must be capable of being scanned electronically for filing on a computer.
3. Reviewed submittals shall be returned in PDF electronic format for the Contractor's printing and distribution.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel deck: Steel shall conform to ASTM A653, Grade 40, unless otherwise shown on the drawings. Depths and gages are as shown on the drawings. The types, design, and function of steel decks shown are specified to products as manufactured by Canam USA (manufacturers of United Steel Deck products). Equivalent products meeting design requirements will be accepted if approved by the Architect prior to the award of the Contract.

B. Finish flashing: Of not less than 18 gage galvanized sheet steel, except as approved for a particular use, to close openings between floor units and columns, beams, and girders where required.

C. Finishes: Composite steel deck, closures, etc. shall be hot-dipped galvanized according to ASTM A153.

2.2 ACCESSORIES

A. Provide minimum 18 gage galvanized end closures and change of direction plates, minimum 18 gage side closure plates. The appropriate gage shall be designed by a structural engineer in contractor's direct employ and shown on the shop drawings submitted for Architect's approval.

B. Hanger tabs: Provide hanger tabs or tab extenders in such numbers and locations as required for ceiling suspension systems and mechanical and electrical requirements. Contractor shall carefully coordinate number and location of hanger tabs with the respective trades of the ceiling construction. Unless otherwise directed, hanger tabs or tab extenders shall be spaced 4' on centers each way, designed to support a maximum allowable load of 40 lbs. per hanger.

C. Surface Finishes: Accessories shall receive, before being formed, a zinc coating conforming to ASTM A525, wiped coating designation G90.

D. Where bottom of deck is above top flange of beam, provide permanent supporting seat or filler, 18 gage minimum.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Steel deck, miscellaneous items and accessories shall be delivered, stored, handled, and installed so as not to be damaged or deformed. Failure to wire brush and paint rusted areas immediately upon detection shall be cause for rejection. Decking stored at the site before erection shall be stacked on platforms or pallets and covered with tarpaulins or other suitable covering to provide weather tight enclosure while affording proper air circulation. The decking shall not be used for storage or as a working platform until the sheets have been securely fastened in position and shall not be damaged or overloaded during the entire construction period.

3.2 ERECTION

A. Steel Deck shall be installed according to the manufacturer's recommendations. Deck units shall be in lengths to span over three or more supports wherever possible.

B. The deck shall be fastened to supporting steel by electric arc welding. Care shall be exercised in the selection of electrodes and amperage to provide positive welds and prevent high amperage blow holes. Welds shall be made from the top side of the deck with the welder following close behind the placement crew.

C. Puddle welds shall be at least 3/4" diameter or an elongated weld having an equal perimeter. Fillet welds, when used, shall be approximately 1" long. Weld metal shall penetrate all layers of deck material at end laps and side joints and have good fusion to the supporting members.

D. The minimum weld spacing shall be such as to hold the deck against 30 PSF gross uplift and to provide lateral stability to the top flange of the supporting structural members. The weld spacing between the adjacent attachment points shall not exceed 12" on center. The adjacent sheets shall be fastened together at maximum spacing of 24” on center.

E. All portions of Steel Deck omitted due to the installation of hoists or for future installation of mechanical equipment, chutes, or other requirements shall be installed or patched and be repaired by the Contractor at no additional cost to the Owner.

F. Furnish, install, and weld into position all closures and flashings.

3.3 CUTTING AND PATCHING

A. Do all cutting and fitting as may be necessary to provide openings around columns, ducts, and other penetrations required in connection with decking. All cutting and fitting shall be performed in accordance with the design drawings and approved shop drawings.

B. In addition to the above, cut out and notch for pipes, conduits, etc. which will penetrate the steel deck and which are indicated on the Heating, Ventilating, Air Conditioning, Plumbing, Drainage, and Electrical drawings.

C. Reinforce all openings to produce rigid installations in conformance with required design loads in the installed work.

END OF SECTION 05 31 00

SECTION 05 40 00 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cold-formed metal framing for:

1. Exterior load-bearing steel stud walls.
2. Exterior steel stud curtain walls.

B. Bridging, bracing, clips and other accessories.

1.2 RELATED SECTIONS

A. Section 09 21 16 - Non-Structural Metal Framing

B. Section 09 29 00 - Gypsum Board: Gypsum Interior Sheathing.

C. Section 09 77 20 - Decorative Fiberglass Reinforced Wall Panels

1.3 REFERENCES

A. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

B. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

C. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

E. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

F. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

G. AISI - Standard for Cold-Formed Steel Framing General Provisions.

H. AISI - North American Specification (NASPEC) for the Design of Cold-Formed Steel Structural Members - 2001.

I. CCFSS Technical Bulletin: AISI Specification Provisions for Screw Connections.

J. American Welding Society (AWS).
   a. AWS D1.1 "Structural Welding Code - Steel."
   b. AWS D1.3 "Structural Welding Code - Sheet Steel."

K. AISI/COS 2001 - Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Story Family Dwelling.

1.4 DESIGN REQUIREMENTS

A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.

B. Design loads: As indicated on the Structural Drawings.

C. Design framing systems to withstand design loads without deflections greater than the following:

1. Exterior Walls: Lateral deflection of: L/600.
2. Interior Load-Bearing Walls: Lateral deflection of: L/360

D. Design framing systems to provide for movement of framing members 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 (range) of 67 degrees C (120 degrees F).

E. Design framing system to accommodate deflection of primary building structure and construction tolerances.

F. Design exterior non-load-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.

1.5 SUBMITTALS

A. Submit under provisions of Division 1 Submittal Section.

B. Product Data: Submit manufacturer's product literature and data sheets for specified products.

C. Manufacturers certification of product compliance with codes and standards.

D. Shop Drawings: Submit shop drawings showing:

1. Locations of framing members, wall framing sections and opening elevations.
2. Sizes and spacing of framing members.
3. Methods of fastening framing members to each other and to supporting systems.
4. Details of vertical deflection connections to structures.
5. Locations and spacing of lateral bracing and structural bracing systems.
6. Accessory products required for complete installation.
7. Shop Drawings shall be signed and sealed by a registered PE (Professional cold-formed specialty Engineer) registered in the state of the project.

E. Structural Calculations: Submit structural calculations for approval for cold-formed framing members and connections not otherwise detailed in the drawings.

1. Submittal shall be signed and sealed by a registered PE (Professional cold-formed specialty Engineer) registered in the state of the project.
2. Description of design criteria.
3. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
4. Selection of framing components, accessories, fasteners and welded connection requirements.
5. Engineer shall have a minimum of 5 years experience with projects of similar scope.

1.6 QUALITY ASSURANCE

A. Contractor shall provide effective, full time quality control over all fabrication and erection complying with the pertinent codes and regulations of government agencies having jurisdiction.

B. Installer of cold-formed metal framing shall have not less than 3 years experience in installation of cold-formed metal framing on projects similar in material, design, and size to this project.

C. Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions. Review areas of potential interference and conflicts and coordinate layout and support provisions for interfacing work.

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel" and AWS D1.3 "Structural Welding Code-Sheet Steel."

E. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.7 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installing. Replace damaged materials at no cost to Owner.

B. Ventilate to avoid condensation.

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store materials protected from exposure to rain, snow or other harmful weather conditions, at temperature and humidity conditions per the recommendations of ASTM C955.

1.8 WORKMANSHIP

A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Architect.

B. Remove work found to be defective and replace with new acceptable work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All products to be manufactured by current members of the Steel Stud Manufacturers Association (SSMA). Acceptable Manufacturers:

1. ClarkDietrich, 9100 Centre Pointe Drive, Suite 210; West Chester, OH 45069; Tel: (513) 870-1100; Fax: (513) 870-1300; www.clarkdietrich.com
2. The Steel Network, 2012A T.W. Alexander Drive PO Box 13887; Durham, NC 27709; Tel: (919) 845-1025; Fax: (919) 845-1028; www.steelnetwork.com
3. Marino/Ware, 400 Metuchen Rd, South Plainfield, NJ 07080; Tel: (908) 757-9000; Fax: (908) 941-0005; www.marinoware.com

B. System Components: Manufacturer's standard load-bearing steel studs and joists of type, size, shape, and gauge as indicated. With each type of metal framing required, provide manufacturer's standard steel track, bridging, blocking, headers, clip angles, reinforcements, fasteners, and accessories for application indicated as needed to provide a complete metal framing system.

C. Requests for substitutions will be considered in accordance with provisions of Division 1 Specifications.

2.2 COMPONENTS

A. Structural Studs: Cold-Formed galvanized steel C-studs.

1. Flange Length: 1 5/8 inch (41mm) 162 flange.
2. Web Depth: As indicated on drawings.
3. Minimum Material Thickness: As required by design unless noted otherwise on drawings.
4. Minimum Yield Strength: As required by design.

B. Structural Track: Cold-Formed galvanized steel runner tracks

1. Flange Length: 1 1/4 inch (32 mm) T125 flange unless noted otherwise on drawings.
2. Web: Track Web Size to match stud web size.
3. Minimum Material Thickness: Track Thickness to match wall stud thickness unless noted otherwise on drawings.
4. Minimum Yield Strength: As required by design.

C. Standard Clip Angels:

1. Clip Angels: Minimum Thickness: 97mils (12ga) 0.0966" (50ksi).
2. Depth: As required for proper fastening to steel structure, manufacturer to provide spacing requirements.

D. U-Channel (CRC Cold Rolled Channel):

1. Size: 150U50-54 1-1/2" (38mm) 54mils (16ga.).

E. Furring Channel: Furring existing walls and suspended ceiling applications.

1. Size: 087F125-54 7/8" (22mm) Furring Channel 54mils (16ga).
2. Size: 150F125-54 1-1/2" (38mm) Furring Channel 54mils (16ga).
3. Size: As required by design.

F. Framing Accessories: Accessories required in this project.

1. Flat Strapping for X-Bracing.
2. Flat Strapping and bridging for lateral bracing.
3. Gusset Plates.

G. Fasteners:

1. Self-drilling, self-tapping screws; complying with ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
2. Bolts and Nuts: ASTM A 307.
3. Finish: Corrosion-resistant plated finish.

H. Welding Electrodes: As permitted by AWS.

I. Powder-actuated Fasteners: 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 the design load as determined by testing in accordance with ASTM E 1190, performed by a qualified independent Testing Agency.

J. Expansion Anchors: “Kwik-Bolt 3” by Hilti; “Trubolt Wedge Anchors” by ITW Ramset/Red Head; “Power-Stud” by Powers Fasteners; “Wedge-Al,” by Simpson/Strong-Tie; or accepted equivalent.

K. Sleeve Anchors: “HLC Sleeve Anchor,” by Hilti; “Dynabolt Sleeve Anchor,” by ITW Ramset/Red Head; “Power-Bolt,” by Powers Fasteners; “Sleeve-All,” by Simpson/Strong-Tie; or accepted equivalent.

L. Chemical Adhesive Anchors:

1. Anchors to solid concrete, grouted CMU, solid brick, or stone:
   a. Anchors for use when base material temperature is 0˚F or greater: “HIT-Ice” by Hilti; “Epcon A7” by ITW Ramset/Red Head; “AC 100 Plus” by Powers Fasteners; “AT Acrylic-Tie” by Simpson/Strong-Tie; or accepted equivalent.
   b. Anchors for use when base material temperature is 40˚F or greater; “HIT HY 150” or “HIT HY 150 MAX” by Hilti; “Epcon C6” by ITW Ramset/Red Head; “Power-Fast” by Powers Fasteners; “ET Epoxy-Tie” by Simpson/Strong-Tie; or accepted equivalent.
2. Anchors to hollow masonry (brick or hollow CMU):
   a. Anchors for use when base material temperature is 0˚F or greater: “Epcon A7” by ITW Ramset/Red Head; “AC 100 Plus” by Powers Fasteners; “AT Acrylic-Tie” by Simpson/Strong-Tie; or accepted equivalent.
   b. Anchors for use when base material temperature is 40˚F or greater: “HIT HY 20” by Hilti; “Epcon C6” by ITW Ramset/Red Head; “Power-Fast” by Powers Fasteners; “ET Epoxy-Tie” by Simpson/Strong-Tie; or accepted equivalent.
   c. Provide manufacturer’s standard screen tubes for use with anchors.

M. 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. End clips.
5. Foundation clips.
6. Gusset plates.
7. Stud kickers, knee braces, and girts.
8. Hole reinforcing plates.

9. Backer plates.

N. Steel Shapes and Clips: Provided under Section 05 10 00, installed under this section.

O. Anchor Rods: ASTM F 1554, Grade 36, threaded carbon steel hooked rods, galvanized.

P. Nuts: ASTM A 563, Grade and finish to match rod type.

Q. Washers: ASTM F 844, finish to match rod type.

2.3 MISCELLANEOUS MATERIALS

A. Cold-Galvanizing Touch-Up Paint: Complying with ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. Accepted products include: Tnemec-Zinc 90-97 by Tnemec, Inc; ZRC Galvalite by ZRC Worldwide; or accepted equivalent.

2.4 MATERIALS

A. Steel: Galvanized Steel meeting or exceeding the requirements of ASTM A 1003.

1. Coating: Galvanized G60 coating minimum, complying with ASTM C 955.

B. Stud Punch Outs: 12 inches (305mm) from base and every 24 inches (610mm) thereafter.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect supporting substrates and structures for compliance of proper conditions for installation and performance of the cold-formed structural framing.

3.2 PREPARATION

A. Prepare attachment surfaces so that they are plumb, level, and in proper alignment for accepting the clod-formed structural framing.

3.3 FABRICATION

A. Prior to fabrication of framing, submit shop drawings to the architect or engineer to obtain approval.

B. Framing components may be preassembled into panels prior to erecting. Prefabricate panels so they are square, with components attached in a manner which prevents racking and minimizes distortion during lifting and transport.

C. Cut all framing components square for attachment to perpendicular members or as required for an angular fit against abutting members.

D. Plumb, align and securely attach studs to flanges of both upper and lower runners, except that in the case of interior, non-load bearing walls where studs need not be attached to upper or lower runners.

E. In all doubled jamb studs and doubled headers not accessible to insulation contractors, provide insulation equal to that specified elsewhere.

F. Splices in members other than top and bottom runner track are not permitted.

G. Provide temporary bracing where required, until erection is complete.

H. Wire-tying of framing components shall not be permitted.

I. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members within plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finish materials.
2. Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.
3. Length of end bearing members shall be within plus or minus 1/16 inch of length shown.

3.4 INSTALLATION - NON-AXIAL LOAD-BEARING CURTAIN WALLS

A. Runners shall be securely anchored to the supporting structure as shown on the drawings.

B. Jack studs or cripples shall be installed below window sills, above window and door heads, and elsewhere to furnish supports.

C. Lateral bracing shall be provided by use of gypsum board and gypsum sheathing or by horizontal straps or cold-rolled channels. Bracing shall conform to Section D3 of the AISI North American Specification (NAS).

D. Provisions for structure vertical movement shall be provided where indicated on the drawings prepared by the engineer of record.

E. Handling and lifting of prefabricated panels shall be done in a manner so as not to cause distortion in any member.

3.5 INSTALLATION - AXIAL LOAD-BEARING WALLS

A. Install framing in accordance with ASTM C 1007 unless noted otherwise. Securely anchor tracks to the supporting structure as shown on the drawings. Provide fasteners at corners and ends of tracks.

B. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element or they shall be groove welded in a butt joint or spliced together.

C. Provide complete, uniform and level bearing support at the bottom track.

D. Secure wall studs to the top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges as shown in drawings. Do not fasten studs to vertical deflection

clips or deflection slip tracks.

E. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of bridging to supporting structure.

F. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

G. Frame wall openings larger than 2-feet square with double stud at each jamb of frame except where more than two are either shown in drawings or indicated in manufacturer's instructions. Install runner tracks and cripple studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space cripple studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

H.. Frame both sides of expansion and control joints with separate studs. Do not bridge the joint with components of stud system.

I. Install horizontal bridging in stud system, spaced (vertical distance) at not more than 4 feet on center. Weld or screw at each intersection. Provide solid bridging at end bays and at 10 feet maximum on center.

J. Include headers and supporting studs at wall openings as shown on the drawings.

K. Provide wood structural sheathing on both sides at stud walls, as indicated on the drawings at locations designated as "shear walls" for frame stability and lateral load resistance. Position additional studs when necessary or as indicated on the drawings to resist the vertical components.

L. Splices in axially loaded studs are not permitted.

3.6 INSTALLATION – JOISTS

A. Align joist bearing at foundation walls by means of shims and/or non-setting grout.

B. Locate joists or a load distribution member directly over bearing studs at the top of bearing walls.

C. Provide web stiffeners at reaction points and/or points of concentrated loads or where indicated on the drawings.

D. Install joist bridging in floor and roof joist system spaced not more than 8 feet on center. Weld or screw at each intersection. Provide solid bridging at first two end bays and at 10 feet maximum on center.

E. Install additional joists under parallel partitions when the partition length exceeds one-half the joist span, also around all floor and roof openings, which interrupt one or more spanning members unless otherwise noted.

F. Install end blocking where joist ends are not otherwise restrained from rotation.

G. Bridging, blocking and sheathing shall be in place prior to loading roof framing.

H. Splicing of joist, stud, and header framing members shall not be permitted.

3.7 ERECTION TOLERANCES

A. Framing and prefabricated assemblies and trusses:

1. Length of end bearing members: ± 1/16 inch.
2. Vertical alignment of studs: ± 1/8 inch in 10 feet.
3. Horizontal alignment of walls: ± 1/8 inch in 10 feet, 1/4-inch maximum deviation from theoretical line.
4. Framing spacing: ± 1/8 inch from design spacing, 1/2-inch maximum cumulative error.
5. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

B. Bolt or weld wall panels at both horizontal and vertical junctures to produce flush, even, true-to-line joints.

3.5 TOUCH-UP PAINTING

A. After installing framing, wire-brush, clean, and paint scarred areas (scratches, weld burn marks, etc.), welds (shop and field), and rust spots on both surfaces of framing units and supporting steel members.

1. Touch-up paint damaged galvanized surfaces and welded areas with cold-galvanizing paint applied in accordance with manufacturer's instructions.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.

2. Set aside and protect materials suitable for reuse and/or remanufacturing.

3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 05 44 00

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SECTION 05 50 00 - METAL FABRICATIONS

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of metal fabrications as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following (NOT ALL USED):
   1. Steel framing and supports for countertops.
   2. Steel tube reinforcement for low partitions.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   5. Elevator machine beams**,** hoist beams, and divider beams.
   6. Steel shapes for supporting elevator door sills.
   7. Shelf angles, galvanized at exterior wall.
   8. Metal ladders, including Elevator Pit Ladders and Roof Hatch Ladders: Steel.
      a. Exterior ladders galvanized, space side rails 18 inches apart.
      b. Elevator pit ladders – space side rails 18 inches apart.
   9. Elevator pit sump covers.
   10. Miscellaneous steel trim including steel angle corner guards steel edgings and loading-dock edge angles (exterior: galvanized).
   11. Abrasive metal nosings tread: Cast iron – at exterior stairs, cast-in-place.
   12. Loose bearing and leveling plates, galvanized, for applications where they are not specified in other Sections.
   13. Loose steel lintels, galvanized at exterior wall, Steel weld plates and angles not specified in other Sections, for casting into concrete.

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

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

C. Related Requirements:

   1. Division 03 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
   2. Division 04 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

3. Division 05 "Structural Steel Framing," "Metal Stairs" for cast and extruded treads and nosings, "Pipe and Tube Railings," "Decorative Metal," "Decorative Metal Railings."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

B. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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 dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

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

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304 and Type 316L (exterior).

D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304, Type 316L (exterior).

E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

G. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.

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. IKG Industries, a division of Harsco Corporation; Mebac.
b. SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.

H. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm) or as indicated.
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B and structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.064-inch (1.6-mm) nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B and structural steel, Grade 33 (Grade 230); 0.0528-inch (1.35-mm) minimum thickness; hot-dip galvanized after fabrication.

K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

L. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

M. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

N. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

O. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 (interior) Type 316 (exterior) stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1) and Group 2 (A4).

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) and Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Division 09 "Painting." `

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3**,** except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 18 inches (457 mm)] apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 3/4-inch- (19-mm-) square steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. 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.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

    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) Harsco Industrial IKG, a division of Harsco Corporation; Mebac.
        2) SlipNOT Metal Safety Flooring, a division of W. S. Molnar Company; SlipNOT.

7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
9. Galvanize and prime exterior ladders, including brackets.
10. Prime exterior ladders, including brackets and fasteners, with zinc-rich primer.

2.9 ELEVATOR PIT SUMP COVERS

A. Fabricate from welded or pressure-locked steel bar grating Limit openings in gratings to no more than 1 inch (25 mm)] in least dimension.

B. Provide steel angle supports as indicated.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.11 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast iron with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

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. American Safety Tread Co., Inc.
b. Balco, Inc.
c. Barry Pattern & Foundry Co., Inc.
d. Granite State Casting Co.
e. Safe-T-Metal Company, Inc.
f. Wooster Products Inc.

2. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches (38 by 38 mm), for casting into concrete.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

1. Provide two rows of holes for units more than 5 inches (125 mm) wide, with two holes aligned at ends and intermediate holes staggered.

D. Apply bituminous paint to concealed surfaces of cast-metal units.

2.12 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.

C. Prime plates with zinc-rich primer.

2.13 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize and prime loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

D. Shop paint galvanized lintels.

2.14 STEEL WELD PLATES AND ANGLES

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

2.15 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for

use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 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.

B. Anchor supports for operable partitions and overhead grilles securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING NOSINGS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

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

3.5 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

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.

3.6 ADJUSTING AND CLEANING

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

   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 19.

   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 05 50 00

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SECTION 05 51 00 - METAL STAIRS

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of metal concrete-filled egress stairs and as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Preassembled steel stairs with concrete-filled treads
2. Attachment of steel tube railings to metal stairs

B. Related Sections:

1. Division 03 "Cast-in-Place Concrete" for concrete fill for stair treads and landings.
2. Division 05 "Metal Fabrications" for miscellaneous metal.
3. Division 05 " Pipe and Tube Railing" for pipe and tube railing for metal stairs.
4. Division 09 "Non-Structural Metal Framing" for metal backing for anchoring railings.
5. Division 09 "Resilient Flooring" for rubber treads with integral riders and landing tile.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor is 1.5.

1.4 ACTION SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Paint products.
3. Grout.
4. Erection drawings.

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

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Delegated-Design Submittal: For installed products 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 qualified professional engineer testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.

1. Test railings according ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have produced the types of stairs, landings an railing systems specified in this section for not less than five (5) years.

B. Installer Qualifications: Fabricator of products.

C. 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. Preassembled Stairs: Commercial class.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. 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.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

2.3 FASTENERS

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

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 Painting.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. 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.

E. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

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. Alfab, Inc.
2. American Stair, Inc.
3. Lapeyre Stair.
4. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel channels.

a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch (1.7 mm).

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. 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.
4. Shape metal pans to include nosing integral with riser.

5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 STAIR RAILINGS

A. Comply with requirements of spec section 05 52 13 "Pipe and Tube Railings."

B. Furnish anchors, adapters and brackets required to attach aluminum pipe and tube railing posts to steel stair framing.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning:

1. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. 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.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post installed anchors and bolts.

B. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. 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 required to comply with performance requirements.

3.3 ADJUSTING AND CLEANING

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

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.4 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.
1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 05 51 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of pipe and tube railings at interior egress stairs and exterior areas as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Steel pipe and tube railings.

B. Related Sections:

1. Division 05 "Metal Stairs" for steel tube railings attachments associated with metal stairs,
2. Division 09 “Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.
2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

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

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

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

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

D. Delegated-Design Submittal: For installed products 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 qualified professional engineer and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. 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.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

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. Steel Pipe and Tube Railings:

a. King Architectural Metals
b. Pisor Industries, Inc.
c. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

C. Adapters for mechanical attachment of aluminum pipe railing to steel metal stairs for protection of dissimilar metals.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
2. Aluminum Railings: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Anchor pipe and tube railing to concrete with fascia flanges.

D. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable.
3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel is Indicated: Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
   1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Universal Shop Paint. Note: Do not paint aluminum rails.

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

G. Shop Primer for Galvanized Steel: Water based galvanized metal primer complying with MPI#134.

H. Intermediate Coats and Topcoats: Provide products that comply with Division 09.

I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

   1. Products: Subject to compliance with requirements, provide the following:

      a. ICI Devoe Coatings
      b. Benjamin Moore & Co.
      c. PPG Architectural Finishes Inc.

J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

K. 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.

L. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

   1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.
   2. At exterior rails provide as required sealant, base plate and weep holes to address migration and discharge of water penetration.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage**,** but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. 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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

K. Form changes in direction as follows:

1. By bending or by inserting prefabricated elbow fittings.

L. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of railing members with prefabricated end fittings.

N. 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.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. 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.

Q. For railing posts set in concrete, provide stainless-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 metal plate forming bottom closure.

R. For removable railing posts, fabricate slip-fit sockets from stainless-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.

S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: 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.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

A. For Interior nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with [SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with universal shop primer unless otherwise indicated.
2. Do not apply primer to galvanized surfaces.

D. Shop-Painted Finish: Comply with Division 09 “Painting.”

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or 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 or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

E. Install brackets and adapters to mechanically secure aluminum guardrail posts to steel stair framing to provide separation between dissimilar metals.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets 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.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

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

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 “Painting.”

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

3.8 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 05 52 13

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SECTION 05 73 00 - ARCHITECTURAL METAL RAILINGS

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of pre-engineered, component based architectural metal railings systems at terraces as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Stainless-steel architectural railings **at** exterior locations.

B. Related Sections:

1. Division 03 “Concrete.”
2. Division 04 “Masonry.”
3. Division 05 "Pipe and Tube Railings" for railings fabricated from pipe and tube components and “Metal Stairs.”
4. Division 09 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Stainless Steel: 60 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.

b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

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

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

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

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Welded connections.
5. Brazed connections.
6. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer and testing agency.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.

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. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. Refer to Section 016000 "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.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.6, "Structural Welding Code - Stainless Steel."

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups as shown on Drawings.
2. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 36 inches (900 mm) in length.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Manufacturer's Quality Assurance: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application. Submit certification that the manufacturer has not less than 5 years experience producing the product specified in this section. Installation of this product will be done by the manufacturer or an approved installer.

G. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.

H. Warranty: Submit manufacturer's standard warranty.

I. Preinstallation Conference: Conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Stainless-Steel Architectural Railings:

a. Architectural Metal Works.
b. Architectural Railings & Grilles, Inc.
c. Blum, Julius & Co., Inc.
d. Blumcraft of Pittsburgh.
e. Livers Bronze Co.
f. P & P Artec.
g. Tri Tech, Inc.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

1. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

2.3 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304 (interior) and Grade MT 316L(exterior).

B. Pipe: ASTM A 312/A 312M, Grade TP 304 (interior) and Grade TP 316L (exterior).

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304 (interior) and Type 316L (exterior).

E. Bars and Shapes: ASTM A 276, Type 304 (interior) and Type 316L (exterior).

2.4 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Stainless-Steel Components: Type 304 (interior) and Type 316L (exterior) stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) and Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

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.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage**,** but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated and as indicated on the Drawings.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. 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 flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:

1. As detailed.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of hollow railing members with prefabricated end fittings.

M. 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.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

O. 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.

P. For railing posts set in concrete, provide stainless-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 metal plate forming bottom closure.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. 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.

B. Form or 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.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post (exterior) and anchoring material flush with adjacent surface (interior).

E. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with sleeves concealed within railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets 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.

   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Payment for these services will be made by Owner.

B. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

3.9 WASTE MANAGEMENT

A. Coordinate with Section 01 74 19.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 05 73 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of rough carpentry as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Wood Preservative Treated Lumber.
2. Fire Retardant Treated Lumber.
3. Misc. Lumber.
4. Plywood backing panels.
5. Un-Treated roof related solid blocking, beveled siding, and plywood.

1.2 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. Data for each type of fastener and anchor.

B. Mockups:

1. Construct 4 foot long mockups of each roof blocking assembly, to show how it will fit, get fastened to, and relate to adjoining building components.

2. Obtain the Architect's approval of each mock up before proceeding with the work. Remove and replace mockups that are rejected; approved mockups may be left in place and incorporated into the finished project.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Powder-actuated fasteners.
4. Expansion anchors.
5. Metal framing anchors.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship".

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

D. Roof blocking:
1. Construction grade Douglas Fir, kiln dried to 15%
2. Utility grade beveled cedar or redwood siding, or equivalent synthetic lumber products.
3. APA rated CDX plywood panels, assembled with exterior glue.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

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.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Do not treat roof related blocking or plywood.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all rough carpentry items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

F. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds

B. Provide miscellaneous lumber for support or attachment of other construction in the following locations **(whether indicated on the plans or not):**

1. All wall mounted counters, shelf millwork units of any kind, and items furnished by the owner requiring wood blocking.
2. Any recessed items requiring wood blocking for attachment and or leveling.
3. Any and all construction elements requiring anchoring to walls and or structure.

C. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

D. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

D. Fasteners for roof related blocking shall be hot dipped galvanized steel; or steel with a proprietary rust inhibiting coating. Utilize minimum #12 diameter screws where ever possible; nails if used, shall have annular ring shanks. Do not use “dry-wall” screws to assemble roof related wood blocking. Anchors bolts shall have be formed of 1/2 inch diameter steel. Drilled anchors shall have 1/4 inch diameter shanks.

2.7 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

J. Roof Blocking:

1. Stagger joints in built up assemblies at least 2 feet to obtain maximum strength. Provide the appropriate shapes needed and adjust wood members to suit existing conditions for full bearing and secure attachment. Discard defective material, and pieces which are too small, and fabricate the work with a minimum of joints and an optimum joint arrangement.

2. Securely attach roof blocking to resist a pull of 275 pounds per lineal foot in any direction. Countersink all fasteners flush.

3. Space fasteners to achieve adequate holding power, generally as follows:

a. Anchor bolts embedded in concrete, anchors drilled into concrete or masonry, screws into a steel deck or structural steel member, or screws into wood framing: 12 inches on center.
b. Nails into wood: 8 inches on center.
c. Install two rows of fasteners on blocking wider than 5 inches.

4. Install blocking neatly scribed and cut to fit within 1/4 inch of adjoining materials. Install blocking, shims and similar supports for the proper attachment of subsequent work.

3.2 PROTECTION

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

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Do not allow roof blocking to get wet while stored or during installation; remove and replace any roof related blocking that gets wet.

3.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 06 10 00

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SECTION 06 16 00 - SHEATHING

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of sheathing as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Wall sheathing.
2. Roof sheathing.
3. Fasteners.
4. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Division 06 "Rough Carpentry".
2. Division 07 “Thermal Insulation”
3. Division 07 “EPDM Roofing”

C. FOR ROOF SHEATHING, REFER TO SPECIFICATION SECTION 07 53 23.

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 plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.2 WOOD PANEL PRODUCTS

A. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.
2. Particleboard underlayment.
3. Hardboard underlayment.

B. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof and wall sheathing within 48 inches (1220 mm) of fire walls.
2. Roof sheathing.

a. Refer to Specification Section 07 53 23 for Gypsum Roof Sheathing. Plywood sheathing may be considered by Architect's Roofing Consultant. Acceptance will depend on condition.

2.5 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing (EXTERIOR WALLS): ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corporation; GlasRoc.
b. G-P Gypsum Corporation; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond e(2)XP.
d. Temple-Inland Inc.; GreenGlass
e. United States Gypsum Co.; Securock.

2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

B. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

C. Nails, Brads, and Staples: ASTM F 1667.

D. Power-Driven Fasteners: NES NER-272.

E. Wood Screws: ASME B18.6.1.

F. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

G. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.
1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 06 16 00

SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of finish carpentry as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Interior trim
2. Interior plywood and hardboard paneling.

B. Related Requirements:

1. Division 06 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 09 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. MDO: Plywood with a medium-density overlay on the face.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors 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 and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for 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.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

B. Sample Warranty: For manufacturer's warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials: The following wood products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

1. Interior trim.
2. Interior plywood and hardboard paneling.
3. Shelving and clothes rods.

B. Certified Wood: The following wood products shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Interior trim.
2. Interior plywood and hardboard paneling.
3. Shelving and clothes rods.

C. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
2. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."

D. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

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

E. Hardboard: AHA A135.4.

F. MDF: ANSI A208.2, Grade 130 made with binder containing no urea-formaldehyde resin.

G. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

H. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Color: As selected by Architect from manufacturer's full range.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.

5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.

    a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

6. Application: Where indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

    1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.

C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.

D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

    1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
    2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

F. Application: Where indicated.

2.4 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

    1. Species and Grade: Eastern white pine, C Select; NeLMA or NLGA.
    2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
    3. Finger Jointing: Not allowed.
    4. Face Surface: Surfaced (smooth).

B. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Eastern white pine, C Select; NeLMA or NLGA.
2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Not allowed.
4. Face Surface: Surfaced (smooth).

C. Moldings for Opaque Finish (Painted Finish): Made to patterns included in WMMPA WM 12.

1. Softwood Moldings: WMMPA WM 4, P grade.

a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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

1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:

1. Interior standing and running trim except shoe and crown molds.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.5 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.6 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 19.
1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 06 20 23

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SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. A. This Section includes the following:

1. Custom built wood cabinets (casework).
2. Custom built plastic-laminate-covered cabinets (plastic-covered casework).
3. Plastic laminate countertops.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, shims, and miscellaneous concealed interior woodwork.
2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.
3. Division 9 Section "Painting" for field finishing of installed interior architectural woodwork.
4. Division 12 Section “Special Casework and Laboratory Equipment” for special casework and epoxy resin countertops.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.

2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.

D. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied transparent finishes.
2. Plastic laminates.

E. Samples for verification of the following:

1. Lumber with transparent finish, 50 sq. in., for each species and cut, finished on one side and one edge.
2. Laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
3. Solid laboratory countertop materials, 6 inches square.
4. Exposed cabinet hardware, one unit for each type and finish.

F. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.

G. 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.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork 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.

B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

C. Quality Standard: Except as otherwise indicated, comply with the following standard:

1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.

a. Provide AWI Certification Labels or Certificates of Compliance indicating that woodwork meets requirements of grades specified.

2. The Contract Documents contain selections chosen from options in the Quality Standard as well as additional requirements beyond those of the Quality Standard. Comply with such selections and requirements in addition to the Quality Standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

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

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 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

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

B. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."

2. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."

C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

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

D. Hardboard: AHA A135.4.

E. MDF: ANSI A208.2, Grade 130 made with binder containing no urea-formaldehyde resin.

F. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

G. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Color: As selected by Architect from manufacturer's full range.

H. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated in the Work include, but are not limited to, the following:

a. Formica Corporation.
b. Laminart.
c. Nevamar Corp.
d. Pioneer Plastics Corp.
e. Westinghouse Electric Corp.; Specialty Products Div.
f. Ralph Wilson Plastics Co.

I. Adhesive for Bonding Plastic Laminate: Contact cement.

J. Adhesive for Bonding Plastic Laminate: Aliphatic resin.

2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General: Manufacturer's standard units complying with ANSI A156.9, of type, material, size, and finish as selected from manufacturer's standard choices.
1. Exposed Hardware Finishes: For exposed hardware, provide manufacturer’s standard satin finished or brushed aluminum.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.

C. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.

D. Clear, Tempered Float Glass for Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; manufactured by horizontal (roller hearth) process, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

E. Clear, Tempered Float Glass for Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.

C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

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 on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
1. Grade: Custom.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.

C. 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 3/4 inch thick or less: 1/16 inch.
2. Edges of rails and similar members more than 3/4 inch thick: 1/8 inch.
3. Corners of cabinets and edges of solid-wood (lumber) members and rails: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

F. Install glass to comply with applicable requirements of Division 8 Section "Glazing" and of FGMA "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 WOOD CABINETS (CASEWORK) WITH TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 400 requirements for wood cabinets. Joints of cabinets shall be multiple doweled, glued and screwed, with full frame top and solid bottom.

1. Grade: Custom.

B. AWI Type of Cabinet Construction: Reveal overlay.

C. Wood Species for Exposed Surfaces: Red oak, rift sawn/cut, unless noted otherwise.
1. Matching of Veneer Leaves: Slip match.
2. Veneer Matching Within Panel Face: Balance match.

D. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other than Drawer Bodies: Match species and cut indicated for exposed surfaces.
2. Drawer Sides and Backs: Solid hardwood lumber, same species indicated for exposed surfaces, shop finished.
3. Drawer Bottoms: ¼ inch tempered hardboard.

2.6 PLASTIC LAMINATE FACE CASEWORK

A. Face Style: Reveal overlay.

B. Face Frame: 1-by-1-5/8-inch solid wood frame rails and stiles with glued mortise and tenon joints.

C. Concealed Surfaces: Sound and dry solid wood, plywood, or particleboard without defects affecting strength, utility, or stability.

D. Sides, Dividers, Tops, Bottoms, Shelves, and Stretchers: Plastic laminate GP 28 on 1/2-inch-thick particleboard. Provide stretchers for top of base cabinet.

E. Back Panels: 1/8-inch-thick hardboard with thermoset decorative panels on interior surfaces fastened to rear edge of end panels and to top and bottom rails.

F. Exposed Edge Treatment: Edge doors and drawer fronts with plastic laminate of same material as exposed faces.

G. Semi-Exposed Edge Treatment: Edge top of drawer body with high-impact plastic tee edging. Edge remaining casework surfaces with plastic laminate GP 28 matching adjoining plastic laminate in color, pattern, and finish.

H. Doors, Drawer Fronts, Fixed Panels, Toeboards, and Ends: Plastic laminate meeting NEMA GP 28 standard for vertical grade on 5/8-inch-thick particleboard.

I. Drawers: Fabricate with front, bottom, and back rabbeted in sides and secured with glue and mechanical fasteners as follows:
   1. Subfronts, Sides, and Backs: 3/8-inch-thick particleboard.
   2. Bottoms: Not less than 1/4-inch-thick particleboard.
   3. Drawer Suspension: Provide for a minimum capacity of 50 lbf, with twin-track, side-mounted, drawer-glide suspension with nylon rollers. Provide self-closing feature and positive stop.

J. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.

2.7 COUNTERTOPS, PLASTIC LAMINATE

A. General: Comply with ANSI A161.2.

   1. Solid color plastic laminate.

B. Plastic Laminate Substrate: Comply with ASTM D 1037.

   1. Particleboard: Comply with ANSI A208.1, 45-lb/cu. ft. density, not less than 3/4 inch thick.
   2. Medium-Density Fiberboard: Comply with ANSI A208.2, not less than 3/4 inch thick.

C. Plastic Laminate Substrate for Countertop with Sink: Exterior grade plywood or phenolic resin particleboard complying with ASTM D 1037.

D. Backer Sheet: Provide BK 20 backer sheet wherever the unsupported countertop area exceeds 4 sq. ft. and substrate is 3/4 inch thick; 6 sq. ft. and substrate is 1 inch thick; 8 sq. ft. and substrate is 1-1/8 inch or thicker.

E. Countertop, Backsplash, and Endsplash Plastic Laminate: NEMA GP 50 standard.

F. Configuration: Provide countertops with the following front style, cove, and backsplash style:

   1. Front Style: Self-edge.
   2. Cove: Applied.
   3. Backsplash and Endsplash Style: Square edge without scribe.

2.8 SHOP FINISHING OF WOOD CABINETS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.

   1. Grade: Provide finishes of same grades as items to be finished.

B. General: The entire finish of wood cabinets is specified in this Section, regardless of whether shop applied or applied after installation.
   1. Shop Finishing: To the greatest extent possible, finish cabinets at the fabrication shop. Defer only final touch up, cleaning, and polishing until after installation.

C. 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, including backs of trim, cabinets, paneling, and ornamental work and the underside of countertops. Apply 2 coats to back of paneling. Concealed surfaces of plastic laminate-clad woodwork do not require backpriming when surfaced with plastic laminate or thermoset decorative overlay.

D. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

E. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.

1. Grade: Custom.
2. AWI Finish System TR-4: Conversion varnish.
3. Staining: None required.
4. Sheen: Semigloss 55-75 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide

unencumbered operation. Complete the installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

F. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

G. Complete the finishing work specified in this Section to the 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 the shop.

H. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

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

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

3.6 CABINET HARDWARE AND ACCESSORY SCHEDULE

A. BHMA numbers are used below to designate hardware requirements, except as otherwise indicated.

B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:
   1. Semiconcealed Hinges for Overlay Doors: B01521.

C. Pulls: Wire pulls, 5 inches long, 2-1/2 inches deep, and 5/16 inches in diameter.

D. Catches: As follows:
   1. Magnetic Catches: B03141.
   2. Push-in Magnetic Catches: B03131.
   3. Friction Catches: B03033.
   4. Ball Friction Catches: B03013.

E. Adjustable Shelf Standards: B04071.
   1. Shelf Rests for Standards: B04081.

F. Drawer Suspension: Epoxy coated self-closing drawer slides with nylon rollers, 2 stage positive stops, and rated for the following loads:
   1. Drawer Slides: 150 lbf.

G. Door Locks: E07121. (ALL DOORS)

H. Drawer Locks: E07041. (ALL DRAWERS)

END OF SECTION 06 40 23

SECTION 07 13 26 SELF-ADHERING SHEET WATERPROOFING

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. The work performed under this Section includes the performance criteria, materials, production, and erection of Self-Adhering Sheet Waterproofing for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all Self-Adhering Sheet Waterproofing as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to the following:

1. Modified bituminous sheet (below grade at outside face of foundations walls),
2. Bonded HDPE sheet for vertical applications.
3. Synthetic plastic hydrophilic expanding concrete water-stop.

B. Related Requirements:
1. Division 03 Concrete
2. Division 04 Masonry
3. Division 07 Thermal and Moisture Protection
4. Division 08 Openings

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review weather barrier requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of sheet waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. Mockup for each type of sheet waterproofing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Fifteen years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials an protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 MANUFACTURERS

A. Basis of Design: CCW MiraDRI 860/861 Sheet Membrane Waterproofing as manufactured by Carlisle Coatings and Waterproofing Incorporated, 900 Hensley Lane, Wylie, Texas 75098, Phone: (800) 527-7092 Fax: (972) 442-0076.

B. Other products, as approved by Architect

1. CETCO Building Materials Group, a subsidiary of AMCOL International Corp;

2. Envirosheet., Meadows, W.R.,Inc; SealTight Mel-Rol.

2.3 PRODUCTS

A. Self-Adhesive Sheet Membrane Waterproofing: Shall be CCW MiraDRI 860/861consisting of a 56 mil rubberized asphalt membrane laminated to 4 mil cross-laminated polyethylene film, and shall meet or exceed the following requirements:

1. Tensile Strength: 325 psi minimum, ASTM D 412
2. Ultimate Elongation: 350% minimum, ASTM D 412
3. Puncture Resistance: 60 lbs. minimum, ASTM E 154
4. Permeance: 0.05 Perm maximum, ASTM E 96 (B)
5. Low Temperature Flexibility: Unaffected at -45^{O}F, ASTM D 1970, 1" mandrel
6. Tensile to Film: 5000 psi, ASTM D 882
7. Thickness: 60 mils, ASTM D 3767
8. Hydrostatic Head: 230 ft., ASTM D 751
9. Water Absorption: 0.1% by wt., ASTM D 570

B. For application temperatures between 25 and 65^{O}F, use CCW-861 Sheet Membrane and CCW-
702. For application temperatures above 40°F use CCW MiraDRI 860 sheet membrane and
CCW-702, CCW-714 primer, or CCW-AWP.

2.4 ACCESSORY PRODUCTS

A. Surface Primer: Shall be CCW-702LV Solvent-Based Contact Adhesive, 702WB or Cav-Grip. B.

B. Mastic: Shall be CCW-704 Mastic.

C. Sealants: Shall be CCW-703 Vertical Grade Liquiseal[7] Membrane, one component approved sealant by CCW, CCW-201 two-component Polyurethane Sealant or CCW LM-800XL

D. Backing Rod: Shall be closed-cell polyethylene foam rod.

E. Protection Course: Shall be CCW Protection Board-H or CCW 300H for horizontal surfaces or CCW Protection Board-V or CCW 200V for vertical surfaces.

F. Drainage Composite: Shall be CCW MiraDRAIN 6200 as recommended by the manufacturer for each condition.

G. Perimeter Drainage System: Where required shall be CCW QuickDRAIN™.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before any waterproofing work is started the waterproofing applicator shall thoroughly examine all surfaces for any deficiencies. Should any deficiencies exist, the architect, owner, or general contractor shall be notified in writing and corrections made.

B. Condition of Concrete Surfaces:
1. The concrete surfaces shall be of sound structural grade and shall have a smooth finish, free of fins, ridges, protrusions, rough spalled areas, loose aggregate, exposed course aggregate, voids or entrained air holes. Rough surfaces shall receive a well-adhered parget coat.
2. Concrete shall be cured by water curing method. Any curing compounds must be of the pure sodium silicate type and be approved by the Carlisle representative.
3. Concrete shall be cured at least 7 days and shall be sloped for proper drainage.
4. Voids, rock pockets and excessively rough surfaces shall be repaired with approved non- shrink grout or ground to match the unrepaired areas.
5. Two-stage drains shall have a minimum 3 inch flange and be installed with the flange flush and level with the concrete surface.
6. Surfaces at cold joints shall be on the same plane.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application. The concrete surface must be thoroughly clean, dry and free from any surface contaminates or cleaning residue that may harmfully affect the adhesion of the membrane.

B. Install a 3/4" face, 45 degree cant of CCW-201 Polyurethane Sealant or CCW LM-800XL at all angle changes and inside corners including penetrations through the deck, walls, curbs, etc.

C. All cracks over 1/16" in width and all moving cracks under 1/16" in width shall be routed out to 1/4" minimum in width and depth and filled flush with an approved sealant by CCW or CCW-201 polyurethane sealant.

D. All expansion joints less than 1" wide shall be cleaned, primed, fitted with a backing rod and caulked with CCW-201 Polyurethane Sealant. For larger joints, contact Carlisle representative.

E. Allow all sealant to cure at least overnight.

F. Stir Primer. Apply a thin film of primer 10" wide, centered over sealed cracks and joints, hairline cracks, and cold joints. Apply primer 8" on each side of all corners. Prime concrete around drain flanges. Allow primer to dry per manufacturer=s recommendations.

G. Install an 8" wide strip of CCW MiraDRI 860/861centered over joints and cracks. Install a 12" wide strip of CCW MiraDRI 860/861centered over the axis of all corners.

H. Terminate membrane around drains per CCW MiraDRI 860 series details. Terminate the membrane under the clamping ring. Seal all edges with CCW-704 Mastic. Do not interfere with weep holes.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Priming: Clean surfaces to remove residual dust before priming. Stir primer. Apply by spray or roller at a rate recommended by manufacturer. Allow to dry per manufacturer=s recommendation.

B. Horizontal surfaces: Install sheet membrane from low to high point, so that laps will shed water. Overlap edge seams 2½", end laps 5". Stagger end seams. Roll in place with an 18 to 24" wide, 100 lb. (min.) resilient roller. Ensure that all laps are firmly adhered and that there are no gaps or fishmouths.

C. Vertical Surfaces: Apply in lengths of 8' or less. Overlap edge seams 2½". On walls over 8' high, apply in 8' sections, starting at the lowest point with the higher section overlapping the lower section 5". Roll in place using firm pressure with a hand roller.

D. Terminations: Consult Carlisle 860-9 Details for proper terminations. Roll terminating edges firmly. Apply CCW-704 mastic to all terminations and >T= joints. Apply CCW-704 Mastic or CCW-703-V Liquiseal to laps at angle changes, extending 9" in each direction.

3.4 INTEGRITY TESTING

A. Test is required for all expanded warranties beyond the standard material warranty of horizontal applications.

B. The test can be done with Electronic Vector Mapping or flood testing. Flood testing requires 2" minimum head of water for a period of 24 hours

3.5 PROTECTION COURSE

A. VERTICAL APPLICATION: Install CCW QuickDRAIN Perimeter Drainage System as the first course of drainage composite immediately after membrane has been installed on vertical surfaces. Install CCW MiraDRAIN Drainage Composite (consult CCW for recommendation),

CCW Protection Board-V Protection Course or CCW 200V on remainder. Stop drainage composite 6" below final grade level.

B. HORIZONTAL APPLICATION: Install CCW MiraDRAIN Drainage Composite (consult CCW for recommendation) or CCW Protection Board-H Protection Course or CCW 300HV immediately after flood testing on horizontal surfaces. If flood testing is delayed, install a temporary covering to protect the CCW MiraDRI 860/861membrane from damage by other trades.

3.6 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 13 26

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the performance criteria, materials, production, and erection of Thermal Insulation for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all Thermal Insulation as required by the this section, schedules, keynotes and drawings including, but not limited to the following:

1. Foam-plastic board insulation.
2. Mineral-wool blanket insulation.
3. Glass fiber blanket insulation.
4. Sprayed polyurethane foam insulation

B. Related Requirements:

1. Division 04 “Masonry”
2. Division 07 “Thermal and Moisture Protection”
3. Division 09 “Finishes”

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 MATERIAL, GENERAL

A. Source Limitations: Obtain insulation materials from single source from single manufacturer.

B. Must meet NYS Energy Code requirements.

2.2 FOAM-PLASTIC BOARD INSULATION – ABOVE GRADE

A. **FOR USE ON ABOVE GRADE CAVITY WALLS**: Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed blue acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:
   1. ASTM C1289 Type 1, Class 2
   2. Compressive Strength (ASTM D1621): 25 psi, minimum.
   3. Aged Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): [R-6.5 at 1 inch] [RSI 1.06 per 25 mm] of thickness [with 15 year thermal warranty]
   4. Flexural Strength (ASTM C203): Minimum 55 psi.
   5. Water Absorption (ASTM C209): Maximum.0.1 percent by volume.
   6. Water Vapor Permeance (ASTM E96): <0.03 perms.
   7. Maximum Use Temperature: 250 degrees F.
   8. Panel Size: 4'-0" wide x 8'-0" long, square edge, shiplap
   9. Thickness and Stabilized R-Value: Nominal 2 inch thickness, R-13.0
   10. Wall assembly must comply with NFPA 285 - 2012

B. Manufacturers subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Dow Chemical Company "THERMAX ci Exterior Insulation.
   2. Other comparable products as approved by Architect

C. Accessories:
   1. Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
      a. Basis of Design: Rodenhouse, Inc. 2 inch diameter "Thermal-Grip" CI prong washer with "Grip-Deck" ceramic- coated, self-drilling screw.
      b.Use the Grip-Lok auto-feed fastening system for high speed application

D. Flashing: Provide insulation manufacturer's recommended board treatment for sealing joints, seams, and veneer tie penetrations through the insulation layer.
   a. Acceptable Products:
      1) Dow Chemical Company LIQUIDARMOR-CM commercial liquid flashing and sealant.
      2) Dow Chemical Company "WEATHERMATE Straight Flashing 4 inch"width with butyl rubber adhesive

E. Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
   a. Acceptable Products:
   1) Dow Chemical Company LIQUIDARMOR-CM commercial liquid flashing and sealant
   2) Dow Chemical Company "WEATHERMATE Straight Flashing 6 inch and 9 inch", with butyl rubber adhesive, at straight opening heads, jambs and sills
   3) When greater widths are required for through wall flashings butyl rubber adhesive is recommended.

F. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
   a. Acceptable Products:
      1) Dow Chemical Company "GREAT STUFF PRO Gaps & Cracks" single Component polyurethane insulating foam sealant.

2) Dow Chemical Company “GREAT STUFF PRO Window & Door” single-component polyurethane low-pressure foam sealant

G. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
1. Acceptable Products:
a) Dow Chemical Company FROTH-PAK Foam Insulation two component, quick-cure polyurethane foam
i) NFPA 286 Approval for Exposed use to the interior of the building without the need for a15-min thermal barrier
ii) ASTM E-84 Class A

H. Flexible polyethylene foam gasket strip to reduce air infiltration between a concrete foundation and sill plate.
a. Acceptable Products: The Dow Chemical Company “STYROFOAM Sill Seal Foam Gasket

2.3 FOAM -PLASTIC BOARD INSULATION – BELOW GRADE

A. **FOR USE BELOW GRADE AND UNDER SLAB:** Rigid closed-cell Extruded-Polystyrene Board Insulation for Perimeter Foundation Wall Installations

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Basis of Design: Dow Chemical Company Perimate Square Edge
   b. DiversiFoam Products.
   c. Owens Corning.
   d. Pactiv Building Products.
2. Wall assembly must comply with NFPA 285 - 2012.
3. ASTM C578-92 Type IV, 25 psi (ASTM D 1621-73)
4. Density 1.6 lb/cu. Ft. min
5. Thickness 2” unless otherwise indicated
6. UL classification: D369.
7. Thermal resistance: 5-year aged R-values of 5.4 and 5.0 min., $^{o}F\text{-}ft^2\text{-}h/Btu^2$/inch at $40^{o}F$ and $75^{o}F$ respectively (ASTM C 518-91).
8. Water absorption: Max. 0.3% by volume (ASTM C 272-91).

2.4 MINERAL-WOOL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Fibrex Insulations Inc.
2. Isolatek International.
3. Owens Corning.
4. Roxul Inc.
5. Thermafiber.

B. Unfaced, Mineral-Wool Board Insulation (at cavity wall edge of slab, fire-safing conditions): ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Foil-faced, Mineral-Wool Board Insulation (at storefront wall edge of slab and spandrel panel locations): ASTM C612; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke – developed indexes of 25 and 5, respectively, per ASTM E84.

2.5 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.6 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.7 SPRAYED POLYURETHANE FOAM INSULATION

A. Spray Polyurethane Foam Installer shall be certified by spray foam manufacturer.

B. Pre-Installation Meeting to review spray polyurethane foam methods and procedures related to application, including manufacturer’s installation guidelines.

C. Mock-up illustrating typical conditions. Conduct the following tests on the mockup panel:
1. Core density
2. Adhesion between transition sheet membrane and substrate
3. Cohesion or adhesion between sprayed insulation and substrate

D. Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during any 24 hours after application to maintain non-toxic, unpolluted, safe working condition.

E. Protect workers as recommended by insulation manufacturer.

F. Protect adjacent surfaces and equipment from damage by overspray, fall-out and dusting of insulation materials.

G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Basis of Design: Dow Chemical Styrofoam Spray Polyurethane Foam Insulation (MX Series)
2. Certa Spray Closed Cell Foam Insulation by CertainTeed
3. Icynene ProSeal MD-C-200v3
4. Substitutions: Approved equal

H. Spray Polyurethane Foam: Two-component spray polyurethane cellular plastic foam, complying with the following methods and meeting the following physical properties:

1. Core Density (ASTM D1622): Minimum 2pcf
2. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.0/inch.
3. Flame Spread (ASTM E84, Class A): 25 or less.
4. Smoke Developed (ASTM E84, Class A): 450 or less.
5. Compressive Strength minimum (ASTM D1621, 10% parallel to rise): (20 psi)(182 kPa).
6. Closed Cell Content (ASTM D2856): minimum 95 percent.
7. Water Absorption by Volume maximum. (ASTM D2842): 2.5 percent.
8. Wall assembly must comply with NFPA 285 - 2012

I. For oily steel surface like Z-bar, roof deck, curtain wall pan, aluminum tube or PVC pipes cleaning, etching or a primer may be needed before spraying polyurethane foam. Water Vapor Permeability maximum. (ASTM E96): [2.5 perm-inches] [3.6 ng/(Pa.s.m)].

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm**)** below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm**)** in from exterior walls.

C. Cut insulation to fit snugly around pilasters, projections, curves and irregularities on the wall surface. Fill voids with insulation.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install 2” diameter daubs of adhesive spaced approximately 12 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

2. Wedge insulation from outside wythe of construction with small fragments of masonry materials spaced 24" o.c. both ways.

3. Make insulation continuous. Fill all voids

3.4 INSTALLATION OF INSULATION FOR FRAMED 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 Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward as indicated on Drawings.
    b. Interior Walls: Set units with facing placed as indicated on Drawings.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF STOREFRONT-WALL INSULATION

A. Install board insulation in storefront-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.7 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 INSTALLATION OF FOAM INSULATION

A. Verify existing conditions are ready to receive work.

B. Ensure surfaces are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.

C. Ensure that items required to penetrate sprayed insulation are installed prior to installation of sprayed insulation.

D. Clean area of work prior to application of sprayed insulation. Beginning of application implies acceptance of existing conditions.

E. Mask and cover adjacent areas to protect from overspray.

F. Apply any required primers for special conditions as recommended by manufacturer. Prepare surfaces within the exterior soffit at the pool to receive sprayed foam insulation where indicated.

G. Cover wide joints with transition sheet membrane as specified in Section 07 27 50.

H. Seal any voids between the existing precast concrete T’s and adjoining building components.

I. Must be installed by manufacturer’s Approved Applicator at time of bidding.

J. Apply SPF in accordance with ASTM C1029 and manufacturer’s installation guidelines: complying with preparation methods.

K. Apply sprayed foam insulation in consecutive layers of not less than ½ inch and not more than 2 inch thick each to achieve total thickness required (total thickness as indicated per application) for a minimum R value of 25. For light gage steel and extruded polystyrene board first layer should be a skim coat of (12 mm) (½ inch) before adding extra layers. Ensure the substrate is well supported.

L. Avoid formation of sub-layer air pockets.

M. Apply product in overlapping layers, so as to obtain a smooth, uniform surface.

N. Maintain 3 inch clearance around chimneys, heating vents, steam pipes, recessed lighting fixtures and other heat sources.

O. Do not apply Product to inside of exit openings or electrical junction boxes.

P. Conduct field inspection and testing in accordance with manufacturers and general contractors instructions.

Q. Test completed application daily for core density and cohesion/adhesion to substrate. Record results daily in daily work records.

R. Site Tolerances: Maximum Variation in Applied Thickness: minus 1/4 inch, plus 5/8 inch.

S. Remove overspray from non-prescribed surfaces without causing damage to surfaces.

T. Remove protective covers from adjacent surfaces.

U. Protect completed installation from damage Repair as required.

V. Any open flame or welding shall not be in contact with the Spray Polyurethane Foam.

W. All plastic insulation must be protected from interior occupancy space by an approved thermal barrier to meet the requirements of local Building Codes.

3.9 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.
   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 21 00

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the performance criteria, materials, production, and erection of Thermal Insulation for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all Thermal Insulation as required by the this section, schedules, keynotes and drawings including, but not limited to the following:

1. Foam-plastic board insulation.
2. Mineral-wool blanket insulation.
3. Glass fiber blanket insulation.
4. Sprayed polyurethane foam insulation

B. Related Requirements:

1. Division 04 “Masonry”
2. Division 07 “Thermal and Moisture Protection”
3. Division 09 “Finishes”

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 MATERIAL, GENERAL

A. Source Limitations: Obtain insulation materials from single source from single manufacturer.

B. Must meet NYS Energy Code requirements.

2.2 FOAM-PLASTIC BOARD INSULATION – ABOVE GRADE

A. **FOR USE ON ABOVE GRADE CAVITY WALLS**: Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed blue acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:
   1. ASTM C1289 Type 1, Class 2
   2. Compressive Strength (ASTM D1621): 25 psi, minimum.
   3. Aged Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): [R-6.5 at 1 inch] [RSI 1.06 per 25 mm] of thickness [with 15 year thermal warranty]
   4. Flexural Strength (ASTM C203): Minimum 55 psi.
   5. Water Absorption (ASTM C209): Maximum.0.1 percent by volume.
   6. Water Vapor Permeance (ASTM E96): <0.03 perms.
   7. Maximum Use Temperature: 250 degrees F.
   8. Panel Size: 4'-0" wide x 8'-0" long, square edge, shiplap
   9. Thickness and Stabilized R-Value: Nominal 2 inch thickness, R-13.0
   10. Wall assembly must comply with NFPA 285 - 2012

B. Manufacturers subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Dow Chemical Company "THERMAX ci Exterior Insulation.
   2. DiversiFoam Products.
   3. Owens Corning
   4. Other comparable products as approved by Architect

C. Accessories:
   1. Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
      a. Basis of Design: Rodenhouse, Inc. 2 inch diameter "Thermal-Grip" CI prong washer with "Grip-Deck" ceramic- coated, self-drilling screw.
      b.Use the Grip-Lok auto-feed fastening system for high speed application

D. Flashing: Provide insulation manufacturer's recommended board treatment for sealing joints, seams, and veneer tie penetrations through the insulation layer.
   a. Acceptable Products:
      1) Dow Chemical Company LIQUIDARMOR-CM commercial liquid flashing and sealant.
      2) Dow Chemical Company "WEATHERMATE Straight Flashing 4 inch"width with butyl rubber adhesive

E. Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
   a. Acceptable Products:
   1) Dow Chemical Company LIQUIDARMOR-CM commercial liquid flashing and sealant
   2) Dow Chemical Company "WEATHERMATE Straight Flashing 6 inch and 9 inch", with butyl rubber adhesive, at straight opening heads, jambs and sills
   3) When greater widths are required for through wall flashings butyl rubber adhesive is recommended.

F. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
   a. Acceptable Products:

1) Dow Chemical Company “GREAT STUFF PRO Gaps & Cracks” single Component polyurethane insulating foam sealant.
2) Dow Chemical Company “GREAT STUFF PRO Window & Door” single-component polyurethane low-pressure foam sealant

G. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
1. Acceptable Products:
a) Dow Chemical Company FROTH-PAK Foam Insulation two component, quick-cure polyurethane foam
i) NFPA 286 Approval for Exposed use to the interior of the building without the need for a15-min thermal barrier
ii) ASTM E-84 Class A

H. Flexible polyethylene foam gasket strip to reduce air infiltration between a concrete foundation and sill plate.
a. Acceptable Products: The Dow Chemical Company “STYROFOAM Sill Seal Foam Gasket

2.3 FOAM -PLASTIC BOARD INSULATION – BELOW GRADE

A. **FOR USE BELOW GRADE AND UNDER SLAB:** Rigid closed-cell Extruded-Polystyrene Board Insulation for Perimeter Foundation Wall Installations

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Basis of Design: Dow Chemical Company Perimate Square Edge
   b. DiversiFoam Products.
   c. Owens Corning.
   d. Pactiv Building Products.
2. Wall assembly must comply with NFPA 285 - 2012.
3. ASTM C578-92 Type IV, 25 psi (ASTM D 1621-73)
4. Density 1.6 lb/cu. Ft. min
5. Thickness 2” unless otherwise indicated
6. UL classification: D369.
7. Thermal resistance: 5-year aged R-values of 5.4 and 5.0 min., $^{o}F\text{-}ft^2\text{-}h/Btu^2$/inch at $40^{o}F$ and $75^{o}F$ respectively (ASTM C 518-91).
8. Water absorption: Max. 0.3% by volume (ASTM C 272-91).

2.4 MINERAL-WOOL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Isolatek International.
3. Owens Corning.
4. Roxul Inc.
5. Thermafiber.

B. Unfaced, Mineral-Wool Board Insulation (at cavity wall edge of slab, fire-safing conditions): ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Foil-faced, Mineral-Wool Board Insulation (at storefront wall edge of slab and spandrel panel locations): ASTM C612; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke – developed indexes of 25 and 5, respectively, per ASTM E84.

2.5 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.6 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation (at cavity wall edge of slab, fire-safing conditions): : ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Foil-faced, Mineral-Wool Board Insulation (at storefront wall edge of slab and spandrel panel locations): ASTM C612; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke – developed indexes of 25 and 5, respectively, per ASTM E84.

2.7 SPRAYED POLYURETHANE FOAM INSULATION

A. Spray Polyurethane Foam Installer shall be certified by spray foam manufacturer.

B. Pre-Installation Meeting to review spray polyurethane foam methods and procedures related to application, including manufacturer’s installation guidelines.

C. Mock-up illustrating typical conditions. Conduct the following tests on the mockup panel:
   1. Core density
   2. Adhesion between transition sheet membrane and substrate
   3. Cohesion or adhesion between sprayed insulation and substrate

D. Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during any 24 hours after application to maintain non-toxic, unpolluted, safe working condition.

E. Protect workers as recommended by insulation manufacturer.

F. Protect adjacent surfaces and equipment from damage by overspray, fall-out and dusting of insulation materials.

G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Dow Chemical Styrofoam Spray Polyurethane Foam Insulation (MX Series)
   2. Certa Spray Closed Cell Foam Insulation by CertainTeed
   3. Icynene ProSeal MD-C-200v3
   4. Substitutions: Approved equal

H. Spray Polyurethane Foam: Two-component spray polyurethane cellular plastic foam, complying with the following methods and meeting the following physical properties:

   1. Core Density (ASTM D1622): Minimum 2pcf
   2. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.0/inch.
   3. Flame Spread (ASTM E84, Class A): 25 or less.
   4. Smoke Developed (ASTM E84, Class A): 450 or less.
   5. Compressive Strength minimum (ASTM D1621, 10% parallel to rise): (20 psi)(182 kPa).
   6. Closed Cell Content (ASTM D2856): minimum 95 percent.
   7. Water Absorption by Volume maximum. (ASTM D2842): 2.5 percent.
   8. Wall assembly must comply with NFPA 285 - 2012

I. For oily steel surface like Z-bar, roof deck, curtain wall pan, aluminum tube or PVC pipes cleaning, etching or a primer may be needed before spraying polyurethane foam. Water Vapor Permeability maximum. (ASTM E96): [2.5 perm-inches] [3.6 ng/(Pa.s.m)].

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm**)** below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm**)** in from exterior walls.

C. Cut insulation to fit snugly around pilasters, projections, curves and irregularities on the wall surface. Fill voids with insulation.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install 2” diameter daubs of adhesive spaced approximately 12 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

2. Wedge insulation from outside wythe of construction with small fragments of masonry materials spaced 24" o.c. both ways.

3. Make insulation continuous. Fill all voids

3.4 INSTALLATION OF INSULATION FOR FRAMED 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 Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward as indicated on Drawings.
    b. Interior Walls: Set units with facing placed as indicated on Drawings.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF STOREFRONT-WALL INSULATION

A. Install board insulation in storefront-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to

hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.

2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.7 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 INSTALLATION OF FOAM INSULATION

A. Verify existing conditions are ready to receive work.

B. Ensure surfaces are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.

C. Ensure that items required to penetrate sprayed insulation are installed prior to installation of sprayed insulation.

D. Clean area of work prior to application of sprayed insulation. Beginning of application implies acceptance of existing conditions.

E. Mask and cover adjacent areas to protect from overspray.

F. Apply any required primers for special conditions as recommended by manufacturer. Prepare surfaces within the exterior soffit at the pool to receive sprayed foam insulation where indicated.

G. Cover wide joints with transition sheet membrane as specified in Section 07 27 50.

H. Seal any voids between the existing precast concrete T's and adjoining building components.

I. Must be installed by manufacturer's Approved Applicator at time of bidding.

J. Apply SPF in accordance with ASTM C1029 and manufacturer's installation guidelines: complying with preparation methods.

K. Apply sprayed foam insulation in consecutive layers of not less than ½ inch and not more than 2 inch thick each to achieve total thickness required (total thickness as indicated per application) for a minimum R value of 25. For light gage steel and extruded polystyrene board first layer should be a skim coat of (12 mm) (½ inch) before adding extra layers. Ensure the substrate is well supported.

L. Avoid formation of sub-layer air pockets.

M. Apply product in overlapping layers, so as to obtain a smooth, uniform surface.

N. Maintain 3 inch clearance around chimneys, heating vents, steam pipes, recessed lighting fixtures and other heat sources.

O. Do not apply Product to inside of exit openings or electrical junction boxes.

P. Conduct field inspection and testing in accordance with manufacturers and general contractors instructions.

Q. Test completed application daily for core density and cohesion/adhesion to substrate. Record results daily in daily work records.

R. Site Tolerances: Maximum Variation in Applied Thickness: minus 1/4 inch, plus 5/8 inch.

S. Remove overspray from non-prescribed surfaces without causing damage to surfaces.

T. Remove protective covers from adjacent surfaces.

U. Protect completed installation from damage Repair as required.

V. Any open flame or welding shall not be in contact with the Spray Polyurethane Foam.

W. All plastic insulation must be protected from interior occupancy space by an approved thermal barrier to meet the requirements of local Building Codes.

3.9 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.
   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 21 00

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SECTION 07 27 13 – FIRE RESISTANT, SELF-ADHERING MEMBRANE AIR & VAPOR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. A self-adhered membrane and accessory products of fire-resistant composition for use as an air and vapor barrier in exterior walls.

B. Materials and installation to bridge and seal the following air leakage pathways and gaps:
1. Connections of the walls to the roof air barrier
2. Connections of the walls to the foundations
3. Seismic and expansion joints
4. Openings and penetrations of window frames, door frames, store front, curtain wall
5. Barrier pre-cast concrete and other envelope systems
6. Door frames Piping, conduit, duct and similar penetrations
7. Masonry ties, screws, bolts and similar penetrations
8. All other air leakage pathways through the walls

1.3 RELATED SECTIONS

A. Section 03 30 00 Cast-in-place Concrete

B. Section 04 20 00 Unit Masonry

C. Section 07 21 00 Thermal Insulation

D. Section 07 27 26 Fluid Applied Membrane Air Barriers

E. Section 07 53 23 EPDM Roofing

F. Section 07 92 00 Joint Sealants

G. Section 08 11 13 Hollow Metal Doors and Frames

H. Section 08 51 13 Aluminum Windows

I. Section 09 29 00 Gypsum Board

1.4 REFERENCES

A. American Association of Textile Chemists and Colorists (AATCC) Test Method 127. “Water Resistance – Hydrostatic Pressure Test”

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010 “Energy Standard for Buildings Except Low-Rise Residential Buildings”

C. ASTM C 920 Standard Specification for Elastomeric Joint Sealants

D. ASTM C 1305 Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane

E. ASTM D 882 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension

F. ASTM D 1876 Standard Test Method for Peel Resistance of Adhesive

G. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modifed Bituminous Sheet Materials Used as Steep slope roofing Underlayment for Ice Dam Protection

H. ASTM D 4073 Standard Test Method for Tensile-Tear Strength of Bituminuous Roofing Membranes

I. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

J. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

K. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.

L. ASTM E 154 Standard Test Methods for Water Vapor Retarders used in Contact with Earth under Concrete Slabs, on Walls or as Ground Cover

M. ASTM E 783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

N. ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

O. ASTM E 1354 Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter

P. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials

Q. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

R. National Fire Protection Association (NFPA) 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.5 MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.6 SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. At bid submission, provide evidence to the Architect of installer qualification by the air & vapor barrier manufacturer.

C. Shop drawings showing locations and extent of air & vapor barrier and details of all typical conditions.

D. Manufacturer’s list and description of wall assemblies, incorporating product, tested per NFPA 285

E. Manufacturer's technical data sheets and material safety data sheets for product and accessories.

F. Manufacturer's installation instructions.

G. Certification of compatibility by manufacturer, listing all materials on the project with which the product and accessories may come into contact.

H. Sample of product and transition membrane, minimum 2 inch by 3 inch size.

1.7 PERFORMANCE REQUIREMENTS

A. Installed product and accessories constitute a continuous air barrier, as described in ASHRAE Standard 90.1-2010 Section 5.4.3.1

B. Installed product and accessories shall perform as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration.

C. Installed product and accessories shall exhibit an air leakage rate, infiltration and exfiltration modes, measured after pressure cycling, not to exceed 0.2 L/s*m^2 at 75 Pa (0.040 CFM/ft^2 at 1.57 PSF) according to ASTM E 2357.

D. Installed product and accessories shall perform as a vapor barrier, installed on the predominantly warm side of the insulation.

E. For Type I, II, III and IV construction: Installed product and accessories shall be evaluated to NFPA 285 in wall assemblies of Project.

F. Product shall consist of nominal 0.040 inch (40 mils) thickness composite membrane consisting of an aluminum-faced cross-laminated high density polyethylene sheet laminated with a styrene-butadiene-styrene modified asphalt adhesive.

G. Product shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Air Permeance	Not more than 0.02 L/s*m^2 at 75 Pa (0.004 CFM/ft^2 at 1.57 PSF)	ASTM E-2178
Tensile Strength	Not less than 40 lb$_f$ per inch	ASTM D-882
Puncture Resistance	Not less than 50 lb$_f$	ASTM E 154
Tear Initiation and Propagation	Not less than 30 lb$_f$, machine direction and cross direction	ASTM D 4073
Low Temperature Flexibility	No cracking at minus 20 degrees F, 1 inch mandrel	ASTM D 1970
Fastener Sealability	No water leaking through fastener penetration after 24 h.	ASTM D 1970
Water Resistance	Membrane specimen including a lap shall resist a 55 cm (22 inch) column of water for 5 hours, no leaking or wet through.	AATCC-127, modified static head generated with 5”diameter PVC pipe sealed to specimen
Pull Adhesion	Not less than 16 lb$_f$ per square inch (or report value at substrate failure) on glass-faced gypsum sheathing and concrete masonry unit, substrate prepared with contact adhesive	ASTM D 4541, modified 4 inch puck
Lap Adhesion	Not less than 5 lb$_f$ per inch of width	ASTM D 1876
Water Vapor Permeance	Not more than 0.1 Perm	ASTM E-96, Method B
Surface Burning Characteristics.	Flame Spread Index: Not more than 25 Smoke Generation Index: Not more than 450	ASTM E 84, sample tested at full coverage, cement board substrate, including surface preparation
Measurement of Heat Release Rate by Cone Calorimeter	Effective Heat of Combustion of 0 MJ/kg or less Peak heat release rate of 6.67 kW/m^2 or less Total heat release rate of 1.1 MJ/m^2 or less	ASTM E 1354, membrane applied to glass-faced gypsum sheathing, including surface preparation. 50 kW/m^2 heat flux.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Shall be experienced in applying the same or similar materials and shall be specifically approved in writing by Manufacturer.

B. Single-Source Responsibility: Obtain product and accessories from single manufacturer.

C. Product and Accessories shall comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

D. Pre-Installation Meeting: Convene one week prior to commencing Work of this Section.

E. Field-Constructed Mock-Ups: Prior to installation on Project, apply Product and Accessories on mock-up to verify details under shop drawing submittals, to demonstrate tie-ins with adjoining construction and other termination conditions and to become familiar with properties of materials in application:

F. Construct typical exterior wall panel, 8 feet long by 8 feet wide, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing; illustrating interface of materials and seals

G. Test mock-up in accordance with ASTM E 783 and ASTM E1105 for air and water infiltration

H. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed Product unless it has been inspected, tested and approved.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Refer to current Product MSDS for proper storage and handling.

C. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

D. Store roll materials on end in original packaging. Protect rolls from direct sunlight until ready for use.

E. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees

F. Protect stored materials from direct sunlight.

G. Keep solvent away from flame or excessive heat.

1.10 FIELD CONDITIONS

A. Do not apply product or accessories during rain or accumulating snowfall.

B. Apply product and accessories within approved ambient and substrate temperature range stated in manufacturer’s literature.

C. Do not apply product or accessories over incompatible materials.

D. Observe safety and environmental measures indicated in manufacturer’s MSDS, and mandated by federal, state and local regulations.

1.11 WARRANTY

A. System Warranty: Provide the manufacturer's five (5) year system warranty, including the primary air/vapor barrier and installed accessory sealant and membrane materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 FIRE-RESISTANT, SELF-ADHERING MEMBRANE AIR & VAPOR BARRIERS

A. **TO BE INSTALLED FOR ALL ABOVE-GRADE WALLS OVER TOP OF THE DENSGLASS GOLD SHEATHING (Except For The CMU Walls Behind Brick – See Specification Section 07 27 26).**

B. Basis of Design: Fire Resist™ 705 FR-A by Carlisle Coatings & Waterproofing, Incorporated (CCW). 900 Hensley Lane, Wylie, TX 75098. Phone 1-800-527-7092. Website http://www.carlisleccw.com

C. Other comparable manufacturers and products, as approved by Architect.

2.2 ACCESSORIES

A. Provide from same manufacturer as air barrier membrane

B. Detail Flashing: Similar composition to air barrier membrane. Factory slit to convenient sizes.
1. CCW: Fire Resist 705 FR-A
2. Others: As specified by air barrier membrane manufacturer

C. Contact Adhesive: Liquid or spray-applied for preparing surfaces accepting air barrier membrane
1. CCW: CCW-702 Solvent-Based , CCW-702 LV VOC Compliant, Solvent-Based, CCW-702 WB Water-Based or CAV-GRIP™ Aerosol Spray
2. Others: As specified by air barrier membrane manufacturer

D. Detail Mastic: 1-part material for sealing details. Installation over air barrier membrane.
1. CCW: Universal Single Ply Sealant
2. Others: As specified by air barrier membrane manufacturer

E. Transition Membrane: Tough, elastomeric sheet capable of bridging a 1" gap. Minimum 60 mils thickness
1. CCW: SURE-SEAL Pressure-Sensitive Elastoform.
2. Others: As specified by air barrier membrane manufacturer

F. Fill Compound: 2-part chemical cure sealant, compatible with adhesive side of air barrier membrane.
1. CCW: CCW-703 V Modified polyurethane, 2-part or CCW-201 Polyurethane, 2-part
2. Others: As specified by air barrier membrane manufacturer

2.3 RELATED MATERIALS

A. Polyurethane Sealant: used for sealing membrane surface defects, penetrations and terminations :
1. Approved by CCW: Sonneborn NP-1, Dymonic FC, S-M 7100 Permathane Pro-Installer by Schnee-Morehead Div, ITW or Xtra-Bond 7500 TX by Premiere Industrial Supply
2. Others: As specified by air barrier membrane manufacturer

B. Silicone Sealant: used for sealing fenestration to air barrier membrane, surface defects and penetrations
1. Approved by CCW: Dow-Corning 758, 790, 791 or 795 or Pecora AVB Silicone, 890, 891 or 895 or GE Silpruf or Silpruf LM
2. Others: As specified by air barrier membrane manufacturer

C. Polyurethane Foam Sealant: used for sealing gaps around fenestration and other penetrations
1. Approved by CCW: Great Stuff by Dow Chemical Company, FireBlock Gun Foam by TVM Building Products or Fireblock Foam Sealant by FOMO
2. Others: As specified by air barrier membrane manufacturer

D. Insulation Adhesive: used for bonding foam board insulation to air barrier membrane
1. Approved by CCW for polyisocyanurate insulation: LM 800 XL or CAV-GRIP Spray Contact Adhesive by Carlisle Coatings & Waterproofing Incorporated
2. Approved by CCW for extruded polystyrene insulation: CAV-GRIP Spray Contact Adhesive by CCW, QB-300 Multi-Pupose Construction Adhesive by OSI or PL-300 VOC Foamboard Adhesive by Loctite
3. Others: As specified by air barrier membrane manufacturer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions affecting installation of the air & vapor barrier and accessory products for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that wall assemblies are dried in, such that water intrusion will not occur from above, behind or around the air barrier installation.

C. Concrete shall be cured for a minimum of seven days. It shall be smooth, with sharp protrusions such as form joints ground flush. Honeycomb and holes/cracks exceeding ¼ inch across shall be filled with grout or mortar.

D. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.

E. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.

F. Mortar joints shall be struck flush and shall be free of voids exceeding ¼ inch across. Mortar droppings shall be removed from brick ties and all other surfaces accepting air barrier.

G. Sheathing boards shall be flush at joints, with gaps between boards according to building code and sheathing manufacturer's requirements. Sheathing boards shall also be securely fastened to the structure with proper fastener type, technique and spacing according to building code and sheathing manufacturer's requirements. Sheathing boards shall be repaired or replaced if inspection reveals moisture damage, mechanical damage or if sheathing boards have exceeded the exposure duration or exposure conditions as required by the sheathing manufacturer.

H. Plywood, OSB, lumber or pressure-treated wood moisture content, measured with a wood moisture meter in the core of the substrate, shall be below 20%.

I. Inform Architect [Consultant] [Owner] in writing of
1. Cracks in concrete and masonry.
2. Gaps or obstructions such as steel beams, angles, plates and projections which cannot be spanned or covered by Product or Accessories.
3. Anticipated problems applying Product and Accessories over substrate.

3.2 SURFACE PREPARATION

A. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane
2. The CMU surfaces shall be free from projections.
3. Strike all mortar joints flush to the face of the concrete block.
4. Fill all voids and holes greater than ¼ inch across at any point with mortar, sealant or other approved fill material.
5. Surface irregularities exceeding ¼ inch in height or sharp to touch shall be ground flush or made smooth.
6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
7. If the surfaces cannot be made smooth to the satisfaction of the Architect, it will be the responsibility of the trade to alternatively apply a parge coat (typically one part cement to three parts sand) over the entire surface to receive Air & Vapor Barrier Membrane
8. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

B. Fill cracks, gaps and joints exceeding ¼ inch width with fill compound or paintable sealant.

C. Fill rough gaps around pipe, conduit and similar penetrations with mortar, non-shrink grout, fill compound or polyurethane foam sealant shaved flush.

D. Apply a ¾ inch cant of fill compound at the intersection of the base of the wall and the footing.

3.3 INSTALLATION

A. Apply product over opaque wall surfaces as indicated in Project.

B. Allow sealants used during surface preparation to cure fully before applying product.

C. Apply contact adhesive to all surfaces accepting product, according to manufacturer's instructions.

D. Apply product to prepared surfaces according to manufacturer's instructions and drawings.

E. Sequence installation to provide shingled laps. Lap neighboring sheets 2 inches minimum.

F. Install detail flashing or transition membrane according to manufacturer's drawings and instructions at expansion joints, seismic joints, mechanical/electrical penetrations and similar conditions.

G. Install detail mastic, polyurethane sealant or silicone sealant covering non-water shedding laps, penetrations and similar surface defects.

3.4 SCHEDULE

A. Wall substrates and roof or temporary roof shall be in place, effectively enclosing interior space, before proceeding with air barrier installation.

B. Seal penetrations made through installed product according to manufacturer's instructions and drawings.

C. Seal fenestration to product with detail membrane, transition membrane, polyurethane sealant, silicone sealant or polyurethane foam sealant according to Project drawings

D. Through-wall flashing may be installed before or after product. Seal termination of metal through-wall flashing to product with 6 inch wide detail flashing.

E. Cladding shall be installed after product.

F. Rigid or semi-rigid insulation installed over product shall be attached with insulation adhesive and mechanical fastening according to insulation manufacturer and air barrier manufacturer's instructions.

G. Sequence Work to enable air barrier continuity at wall-to-foundation, shelf angle, wall-to-roof, fenestration, different wall assemblies and other conditions providing challenges to air barrier continuity.

3.5 REPAIR AND PROTECTION

A. Protect from damage during application and remainder of construction period.

B. Inspect before covering. Repair or replace damaged material according to manufacturer's literature.

C. Product and accessories are not designed for permanent exposure. Cover with insulation or exterior cladding as soon as schedule allows.

D. Outdoor exposure of installed product and accessories shall not exceed 180 days.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 27 13

SECTION 07 27 26 – FIRE RESISTANT, FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. A fluid-applied membrane and accessory products of inherent, fire-resistant composition for use as an air barrier in exterior walls.

B. Materials and installation to bridge and seal the following air leakage pathways and gaps:
1. Connections of the walls to the roof air barrier
2. Connections of the walls to the foundations
3. Seismic and expansion joints
4. Openings and penetrations of window frames, door frames, store front, curtain wall
5. Barrier pre-cast concrete and other envelope systems
6. Door frames Piping, conduit, duct and similar penetrations
7. Masonry ties, screws, bolts and similar penetrations
8. All other air leakage pathways through the walls

1.3 RELATED SECTIONS

A. Section 03 30 00 Cast-in-place Concrete

B. Section 04 20 00 Unit Masonry

C. Section 07 21 00 Thermal Insulation

D. Section 07 27 13 Self Adhering Membrane Air Barriers

E. Section 07 53 23 EPDM Roofing

F. Section 07 92 00 Joint Sealants

G. Section 08 11 13 Hollow Metal Doors and Frames

H. Section 08 51 13 Aluminum Windows

I. Section 09 29 00 Gypsum Board

1.4 REFERENCES

A. American Association of Textile Chemists and Colorists (AATCC) Test

Method 127. “Water Resistance – Hydrostatic Pressure Test”

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010 “Energy Standard for Buildings Except Low-Rise Residential Buildings”

C. ASTM C 920 Standard Specification for Elastomeric Joint Sealants

D. ASTM C 1305 Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane

E. ASTM C 1522 Standard Test Method for Extensibility after Heat Aging of Cold, Liquid-Applied Elastomeric Waterproofing Membrane

F. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modifed Bituminous Sheet Materials Used as Steep slope roofing Underlayment for Ice Dam Protection.

G. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

H. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

I. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.

J. ASTM E 783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

K. ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference

L. ASTM E 1354 Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter

M. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials

N. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

P. National Fire Protection Association (NFPA) 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.5 MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings and Submittals:

1. Provide evidence to the Architect of licensing and certification under the Air Barrier Association of America's (ABAA's) Quality Assurance Program.
2. Submit shop drawings showing locations and extent of air/vapor barrier and details of all typical conditions, intersections with other envelope systems and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated and how miscellaneous penetrations such as conduits, pipes electric boxes and the like are sealed.
3. Submit manufacturer's product data sheets for each type of membrane, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
4. Submit manufacturer's data showing solids content of fluid applied membranes and coverage rates and wet film thickness upon application in order to achieve minimum dry film thickness required by this specification.
5. Submit manufacturer's installation instructions.
6. Submit certification of compatibility by air/vapor barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it.
7. Submit samples, 3 by 4 inch minimum size, of each air/vapor barrier material required for Project. Apply sample material to substrate to used on project.
8. Test results of air permeability testing of primary air barrier material (ASTM E 2178-01)
9. Test results of assembly in accordance with ABAA test protocol.

1.7 PERFORMANCE REQUIREMENTS

A. Installed product and accessories constitute a continuous air barrier, as described in ASHRAE Standard 90.1-2010 Section 5.4.3.1

B. Installed product and accessories shall perform as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration.

C. Installed product and accessories shall exhibit an air leakage rate, infiltration and exfiltration modes, measured after pressure cycling, not to exceed 0.2 L/s*m^2 at 75 Pa (0.040 CFM/ft^2 at 1.57 PSF) according to ASTM E 2357.

D. Exterior wall assemblies incorporating the product and accessories shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

E. Product shall be of flame-retardant, non-asphalt synthetic polymer composition.

F. Product shall be a nominal 0.040 inch (40 mils) thickness membrane, with dry film thickness of installed product measuring a minimum of 0.030 inch (30 mils) with a comb gauge.

G. Product shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Air Permeance – on Porous Substrate	Not more than 0.02 L/s*m^2 at 75 Pa (0.004 CFM/ft^2 at 1.57 PSF)	ASTM E-2178, mod sprayed on CMU
Air Permeance – Free Film	Not more than 0.02 L/s*m^2 at 75 Pa (0.004 CFM/ft^2 at 1.57 PSF)	ASTM E-2178
Low Temperature Flexibility	No cracking at minus 20 degrees F, 180 degree bend over 1 inch mandrel	ASTM D 1970
Low-Temperature Crack Bridging	No cracking after 10 cycles at minus 15 deg F	ASTM C 1305, mod 40 mil membrane thickness
Long-Term Aging/ Flexibility	No cracking or tearing after aging	ASTM C 1522, mod 40 mil membrane thickness OR CGSB 71-GP-24M
Fastener Sealability	No water leaking through nail penetration after 24 h.	ASTM D 1970
Water Resistance	Product spray-applied to CMU and gypsum sheathing with joint shall resist a 55 cm (22 inch) column of water for 5 hours, no leaking or wet through.	AATCC-127 - mod, static head generated with 5”diameter PVC pipe sealed to specimen
Pull Adhesion	Not less than 16 lbf per square inch (or report value at substrate failure) on glass-faced gypsum sheathing and concrete masonry unit (CMU)	ASTM D 4541, modified 4 inch wood puck
Water Vapor Permeance – Vapor Permeable Type Only	Not less than 10 Perms	ASTM E-96, Method B
Surface Burning Characteristics.	Flame Spread Index: Not more than 25 Smoke Generation Index: Not more than 450	ASTM E 84, sample tested at full coverage, 40 mil dry film, cement board substrate

Measurement of Heat Release Rate by Cone Calorimeter	Average Effective Heat of Combustion: Not more than 12.3 MJ/kg [5,300 BTU/lb] Total Heat Released per Area: not more than 14.7 MJ/m^2 [1,296 BTU/ft^2]	ASTM E 1354, membrane applied to glass-faced gypsum sheathing

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. The air barrier contractor shall be, during the bidding period as well as for the duration of the installation, officially recognized as a Licensed Contractor by the Air Barrier Association of America (ABAA). The contractor shall carry liability insurance and bonding.

2. Each worker who is installing air barriers must be either a Certified Applicator or an installer who is registered with ABAA.

3. Each Lead Certified Applicator can supervise a maximum of five registered installers. The Certified Applicator shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Lead Certified Applicators shall perform or directly supervise all air/vapor barrier work on the project.

B. Air/vapor barrier installers must be trained and certified by NECA (National Energy Conservation Association) and PSDI (Professional Skills Development Institute for energy conservation)

C. Single-Source Responsibility: Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

D. Manufacturer shall be on-site at least once a week to observe installation and provide written report within 3 days.

E. Manufacturer shall confirm all termination details and compatibility with materials being terminated to.

F. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup testing for qualitative air leakage, quantitative air leakage, and adhesion.

C. Field-Constructed Mock-Ups: Prior to installation of air/vapor barrier, apply air/vapor barrier as follows to verify details under shop drawing submittals and to demonstrate tie-

ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution:

1. Construct typical exterior wall panels, size and location as shown on drawing, (one of concrete and one of sheathed areas), incorporating back-up wall, opaque cladding, window frame, insulation, flashing, building corner condition, and typical penetrations and gaps; illustrating materials interface and seals.

2. The joints between fenestration product and adjacent wall construction shall be included in the test assembly. Interior wall materials shall not be installed to allow visual access to test area check for leakage.

D. Test mock-ups in accordance with ASTM E783 and ASTM E1105 for air and water infiltration. Approval of all test procedure, remediation measures (if required) and test results rests with the Architect/Owner. Failure criteria shall be defined in the Test Method.

1. The intent of the mock-ups is to identify potential problem areas before the general wall assembly construction is complete so concrete measures (if required) can be taken with minimal impact to construction in-place.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Refer to current Product MSDS for proper storage and handling.

C. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

D. Store roll materials on end in original packaging. Protect rolls from direct sunlight until ready for use.

E. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees min.

F. Protect stored materials from direct sunlight.

G. Keep solvent away from flame or excessive heat.

1.11 FIELD CONDITIONS

A. Do not apply product or accessories during rain or accumulating snowfall.

B. Apply product and accessories within approved ambient and substrate temperature range stated in manufacturer’s literature.

C. Do not apply product or accessories over incompatible materials.

D. Observe safety and environmental measures indicated in manufacturer’s MSDS, and mandated by federal, state and local regulations.

1.12 WARRANTY

A. System Warranty: Provide the manufacturer's five (5) year system warranty, including the primary air/vapor barrier and installed accessory sealant and membrane materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 FIRE-RESISTANT, FLUID APPLIED MEMBRANE AIR BARRIERS

A. **TO BE INSTALLED ABOVE GRADE FOR CMU WALLS BEHIND BRICK**

B. Basis of Design: Carlisle Coatings & Waterproofing, Incorporated. 900 Hensley Lane, Wylie, TX 75098. Phone 1-800-527-7092. Website http://www.carlisle- ccw.com
   1. Vapor-Permeable Type: Fire Resist Barritech VP

C. Other manufacturers and products, as approved by Architect

2.2 ACCESSORIES

A. Provide from same manufacturer as air barrier membrane

B. Detail Flashing: Foil-faced butyl or foil-faced rubberized asphalt flashing, minimum 0.030" (30 mils) thickness. Approved with air barrier membrane in NFPA 285 wall assemblies.
   1. AlumaGRIP-701 by Carlisle Coatings & Waterproofing, Incorporated
   2. Others as approved by air barrier membrane manufacturer

C. Contact Adhesive:

   1. Carlisle Coatings & Waterproofing, Incorporated: CCW-702 Solvent- Based, CCW-702 LV VOC Compliant Solvent-Based, CCW-702 WB Water-Based, CAV-GRIP™ Aerosol Spray or Travel-Tack portable aerosol spray cans
   2. Products by others as approved by Architect.

D. Detail Mastic:
   1. SURE-SEAL Lap Sealant by Carlisle Coatings & Waterproofing, Incorporated
   2. Products by others as approved by Architect

E. Transition Membrane:
   1. CCW SURE-SEAL Pressure-Sensitive Elastoform by Carlisle Coatings & Waterproofing, Incorporated
   2. Products by others as approved by Architect

F. Transition Membrane Primer:
   1. Carlisle Coatings & Waterproofing, Incorporated: SURE-SEAL HP-250 Primer, SURE-SEAL EP-95 Splicing Cement or SURE-SEAL Low VOC EPDM Primer
   2. Products by others as approved by Architect

G. Reinforcing Fabric: Woven, synthetic polymer fabric
   1. DCH Reinforcing Fabric by Carlisle Coatings & Waterproofing, Incorporated
   2. Products by others as approved by Architect

H. Glass Mat: Randomly-oriented glass strands held in binder soluble in wet air barrier membrane. Offered in rolls of various widths
   1. LiquiFiber-W
   2. Products by others as approved by Architect

I. Fill Compound: 2-part, non-sag polyurethane sealant
   1. Carlisle Coatings & Waterproofing, Incorporated: CCW-703 V or CCW-201
   2. Products by others as approved by Architect

2.3 RELATED MATERIALS

A. Paintable Sealant, select any:
   1. Sikaflex-1A 1-part polyurethane sealant
   2. Sonneborn NP-1 1-part polyurethane sealant
   3. ChemLink Novalink 1-part polyether sealant
   4. Pecora AC-20 outdoor grade, acrylic latex sealant
   5. DAP ALEX PLUS outdoor grade, acrylic latex sealant
   6. Other product approved by air barrier membrane manufacturer

B. Silicone Sealant, select any:
   1. Dow 790, 791, 795
   2. Pecora 890, 891, 895
   3. GE Silpruf, Silpruf LM
   4. Other product approved by air barrier membrane manufacturer

C. Polyurethane Foam Sealant, select any:
   1. Great Stuff by Dow Chemical Company
   2. Froth Pack by Dow Chemical Company
   3. Other product approved by air barrier membrane manufacturer

D. Insulation Adhesive, select any
   1. Sonneborn Premium Adhesive
   2. QB-300 Multi-Pupose Construction Adhesive by OSI
   3. PL-300 VOC Foamboard Adhesive by Loctite
   4. Other product approved by air barrier membrane and board foam insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the System. Examine substrates, areas, and conditions affecting installation of the air & vapor barrier and accessory products for compliance with requirements. Verify that surfaces and

conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that wall assemblies are dried in, such that water intrusion will not occur from above, behind or around the air barrier installation.

C. Concrete shall be cured for a minimum of seven days. It shall be smooth, with sharp protrusions such as form joints ground flush. Honeycomb and holes/cracks exceeding ¼ inch across shall be filled with grout or mortar.

D. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.

E. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.

F. Mortar joints shall be struck flush and shall be free of voids exceeding ¼ inch across. Mortar droppings shall be removed from brick ties and all other surfaces accepting air barrier.

G. Sheathing boards shall be flush at joints, with gaps between boards according to building code and sheathing manufacturer's requirements. Sheathing boards shall also be securely fastened to the structure with proper fastener type, technique and spacing according to building code and sheathing manufacturer's requirements. Sheathing boards shall be repaired or replaced if inspection reveals moisture damage, mechanical damage or if sheathing boards have exceeded the exposure duration or exposure conditions as required by the sheathing manufacturer.

H. Plywood, OSB, lumber or pressure-treated wood moisture content, measured with a wood moisture meter in the core of the substrate, shall be below 20%.

I. Inform Architect in writing of
1. Cracks in concrete and masonry.
2. Gaps or obstructions such as steel beams, angles, plates and projections which cannot be spanned or covered by Product or Accessories.
3. Anticipated problems applying product and accessories over substrate.

3.2 SURFACE PREPARATION

A. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane
2. The CMU surfaces shall be free from projections.
3. Strike all mortar joints flush to the face of the concrete block.
4. Fill all voids and holes greater than ¼ inch across at any point with mortar, sealant or other approved fill material.
5. Surface irregularities exceeding ¼ inch in height or sharp to touch shall be ground flush or made smooth.
6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
7. If the surfaces cannot be made smooth to the satisfaction of the Architect, it will be the responsibility of the trade to alternatively apply a parge coat (typically one part

cement to three parts sand) over the entire surface to receive Air & Vapor Barrier Membrane

8. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

B. Fill cracks, gaps and joints exceeding ¼ inch width with fill compound or paintable sealant.

C. Fill rough gaps around pipe, conduit and similar penetrations with mortar, non-shrink grout, fill compound or polyurethane foam sealant shaved flush.

D. Apply a ¾ inch cant of fill compound at the intersection of the base of the wall and the footing.

3.3 DETAILING

A. Additional materials and installation are required at joints, transitions, openings, terminations, penetrations and similar surface irregularities. Perform detailing before or after product installation.

B. Install product and accessories in details as directed in manufacturer's literature.

C. Sheathing joints, use any of the following methods:
1. 4 inch detail flashing centered over joint.
2. 4 inch reinforcing fabric imbedded in product and centered over joint.
3. Paintable sealant or fill compound, tooled as shown in details.

D. Sheathing inside and outside corners. Flashing or reinforcement shall bear 3 inches minimum onto either side of angle change. Use any of the following methods:
1. Minimum 9 inch detail flashing centered over angle change
2. 12 inch reinforcing fabric centered over angle change and imbedded in product
3. 12 inch glass mat centered over angle change and imbedded in product

E. Window openings. Flashing or reinforcement shall bear onto wall 3 inches minimum and shall return into window opening according to Project drawings. Use any of the following methods:
1. Detail flashing
2. Glass mat imbedded in product

F. Pipe or duct penetrations. Flashing or reinforcement shall bear onto wall 3 inches minimum and shall bear onto pipe or duct 3 inches, or according to Project drawings. Select any:
1. Detail flashing
2. Glass mat imbedded in product

G. Expansion or deflection joints. Flashing shall bear 3 inches minimum onto either side of joint. Select any:
1. Detail flashing bellows or expansion bulb
2. Transition membrane expansion bulb

H. Interface of dissimilar substrates: Flashing or reinforcement shall bear 3 inches minimum onto either side of joint. Select any:
1. Minimum 9 inch detail flashing
2. 12 inch reinforcing fabric imbedded in product
3. 12 inch glass mat imbedded in product

3.4 INSTALLATION

A. Apply product over opaque wall surfaces as indicated in Project drawings.

B. Spray or roller-apply product to achieve specified thickness in accordance with manufacturer's literature.

3.5 SCHEDULE

A. Wall substrates and roof or temporary roof shall be in place, effectively enclosing interior space, before proceeding with air barrier installation.

B. Seal penetrations made through installed product according to manufacturer's instructions and drawings.

C. Seal fenestration to product with detail membrane, transition membrane, polyurethane sealant, silicone sealant or polyurethane foam sealant according to Project drawings

D. Through-wall flashing may be installed before or after product. Seal termination of metal through-wall flashing to product with 6 inch width counter-flashing strip consisting of any of these:
1. Detail flashing
2. Reinforcing fabric imbedded in product
3. Glass mat imbedded in product

E. Cladding shall be installed after product.

F. Rigid or semi-rigid insulation installed over product shall be attached with insulation adhesive and mechanical fastening according to insulation manufacturer and air barrier manufacturer's instructions.

G. Sequence Work to enable air barrier continuity at wall-to-foundation, shelf angle, wall-to-roof, fenestration, different wall assemblies and other conditions providing challenges to air barrier continuity.

3.6 REPAIR AND PROTECTION

A. Protect from damage during application and remainder of construction period.

B. Inspect before covering. Repair or replace damaged material according to manufacturer's literature.

C. Product and accessories are not designed for permanent exposure. Cover with

insulation or exterior cladding as soon as schedule allows.

D. Outdoor exposure of installed product and accessories shall not exceed air manufacturer's published limit.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 27 26

SECTION 07 53 23 - EPDM ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of EPDM Roofing, as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Install a new fully adhered unreinforced 60 mil thick EPDM roofing system, including a vapor barrier on concrete deck areas, insulation, a cover board, flashings, stripping and related accessories.

2. Install new flashings at the roof drains, and all roof-mounted and roof-penetrating equipment.

B. Related Requirements

1. Rough Carpentry - Section 06 10 00
2. Sheet Metal Flashing & Specialties - Section 07 62 00
3. Roof Accessories - Section 07 72 00

1.2 CODE APPROVAL REQUIREMENTS

A. Install roofing and insulation system components to meet the following minimum requirements:

1. New York State Uniform Fire Prevention and Building Code.
2. Underwriters Laboratories Inc. Class A external fire rating for Roof Covering Materials.
3. ASCE 7-16 minimum uplift resistance, calculated using a safety factor of 2

B. Provide written certification from the Manufacturer, before beginning work, to confirm the roofing system meets these requirements.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. A firm (Installer) with at least 5 continuous years experience performing EPDM roofing work similar to that required for this project, employing personnel skilled in the specified work.
   a. The Installer shall directly employ the personnel performing the work of this section.
   b. The Installer shall have a full time supervisor/foreman on the roof when roofing work is in progress. The Supervisor shall have a minimum of 5 years experience in EPDM roofing work similar in nature and scope to this project, and speak fluent English.

2. The Installer shall provide a reference list of at least three projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:

   a. The reference list shall include the completion date, a description of the work performed, the Owner’s name - contact person - phone number and address and the Architect’s name - contact person and phone number.
   b. The Installer shall provide the reference list prior to contract award if requested.

3. The Installer shall be acceptable to or licensed by the Manufacturer of the primary roofing materials, and provide written certification from the Manufacturer to confirm this prior to award if requested.

B. Material Quality: Obtain each product, including the vapor barrier, insulation, cover board, EPDM roofing and flashing, and the cements, primers and adhesives from a single Manufacturer, which has manufactured the same products in the United States of America for not less than 5 continuous years.

C. Pre-Work Conference: Meet at the project site approximately 10 days prior to starting work, with the Architect, Owner and other representatives concerned about the work, to discuss the following:

1. How the existing building will be kept watertight as old roofing is removed and the work progresses.
2. How new roofing will be coordinated with the installation of related building components, including the drains and mechanical equipment, the vapor barrier, insulation, cover board, flashings and other items to provide a watertight installation.
3. Generally accepted industry practice, the Manufacturer's instructions for handling and installing his products, and specified work requirements.
4. The condition of the existing and new substrates (decks), curbs, penetrations and other preparatory work needed.
5. Submittals, both completed and yet to be completed.
6. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
7. A schedule for Manufacturer and Architect inspections.

1.4 SUBMITTALS

A. Submit the following items far enough in advance to obtain approval prior to performing any work:

1. Written certification from the Manufacturer which states that the Installer is acceptable or licensed to install the specified roofing; if not previously provided.
2. Manufacturer’s installation instructions and technical data sheets for each component of the roofing system. Material sample submittals are not needed or wanted.
3. Samples of the Contractor’s and Manufacturer’s guarantee/warranty forms.
4. Technical submittals shall be prepared and made by the firm that will perform the actual work.
5. Payment requisitions will not be processed until all submittals are received and approved.

1.5 JOB CONDITIONS (CAUTIONS & WARNINGS)

A. Do not use oil base or plastic roof cement with EPDM roofing. Do not allow waste products, (petroleum grease or oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with any roofing, insulation or flashing product. Do not expose EPDM roofing and accessories to a temperature in excess of 175 degrees Fahrenheit.

B. Splice cleaner, primer, cements and bonding adhesives are flammable. Do not breathe vapors or use near fire or flame or in a confined or unventilated area. Dispense only from a UL listed or approved safety can.

C. Remove empty adhesive and solvent containers and contaminated rags from the roof and legally dispose of them daily.

D. Do not apply adhesives adjacent to open ventilation system louvers, or windows. Temporarily cover the louvers and windows with 6 mil fire retardant polyethylene and prevent adhesive odors from entering the building. Remove temporary covers at the end of each days work.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to the site in the Manufacturer's original and unopened packaging, bearing labels which identify the products and Manufacturers, with the labels intact and legible.

B. Cover all stored materials, except rolls of EPDM and sealed cans of adhesives, with watertight tarpaulins installed immediately upon delivery.

C. Immediately remove any insulation or cover board which gets wet from the job site.

D. Do not overload the structure when storing materials on the roof.

E. Store and install all material within the Manufacturer’s recommended temperature range.

1.7 GUARANTEE/WARRANTY

A. Provide a written Manufacturer's "Full System Guarantee/Warranty" which warrants that the roofing system, including the insulation, cover board, EPDM roofing and flashings, will remain in a watertight condition for a twenty year period beginning upon Final Completion.

1. Guarantee/Warranty coverage shall remain in effect for gust wind speeds up to 72 miles per hour, measured at ground level at the site.

2. Guarantee and Warranty coverage shall have no dollar value limit.

B. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:

1. Defective work includes but is not limited to the following types of failure: leakage, adhesive separation, delamination, lifting, loosening, splitting, cracking, and undue expansion.

2. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense:

3. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.

C. Manufacturer's and Contractor's Guarantees/Warranties shall be issued no more than 30 days before the satisfactory completion of punch list work.

D. Guarantees/Warranties shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to make warranty repairs.

E. Guarantee/Warranty coverage may be cancelled, for the affected portion of the roof, if the work is damaged by winds in excess of 72 mph, by hail, lightning, insects or animals, by failure of the structural substrate, by exposure to harmful chemicals, by other trades on the roof, or by vandalism, or if the Owner fails to maintain the roof in accordance with, or makes roof alterations contrary to, the Manufacturer’s printed recommendations.

F. Guarantee/Warranty coverage shall be reinstated, for the remainder of the original period; if the Owner restores the roof to the condition it was in prior to the damage occurring.

G. The Contractor's Surety Company may add a rider to the Performance Bond which clarifies that Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor's Guarantee.

1.8 SUBSTITUTIONS

A. The following factors will be considered when evaluating a possible alternative to the roofing system specified:

1. The wording and intent of the warranty to be issued.
2. The financial status, numbers of years in business, and stability of the entity that will issue the warranty.
3. A reference list of at least five completed similar projects of comparable size, with a successful functional history of at least five years, within an approximate fifty mile radius of the Project.
4. Technical aspects of the system, especially relating to durability, serviceability and performance.
5. The capacity and history of the Manufacturer in providing technical response, on-site inspections and assistance.
6. The availability and prior experience of local authorized applicators, within a 50 mile radius of the project, to install and maintain the proposed alternate system.
7. The willingness and history of the Manufacturer in responding to warranty claims previously made by the Owner, Architect or any Consultant involved in this project.

PART 2 - PRODUCTS

2.1 GENERAL

A. EPDM roof system components are specified as products of Firestone Building Products Company to establish a standard of quality. Equal products and systems from Carlisle SynTec will be accepted.

B. Primary products required for this project include:

1. Particleboard Underlayment
2. Vapor barrier
3. Roof insulation
4. Cover board
5. EPDM roofing
6. Primers and adhesives
7. Sealants
8. EPDM flashing
9. Fasteners

2.2 PARTICLEBOARD UNDERLAYMENT

A. 1/2-inch-thick particleboard, See Specification 06 16 00 - SHEATHING

2.3 VAPOR BARIER

A. 154 mm thick smooth surfaced APP modified bitumen sheet suitable for torch application over ASTM D 41, Type II asphalt primer applied on concrete deck surfaces.

2.4 INSULATION:

A. Isocyanurate – Rigid cellular polyisocyanurate boards with fibrous felt/fiberglass mat facers, minimum compressive strength 20 psi, meeting ASTM C1289-01, Type II, Class1, Grade 2, as manufactured by Firestone under the trade name of “ISO 95+ Isocyanurate Insulation”.

1. Flat insulation sloped as shown on the roof plan.
2. Crickets sloping 1/4 and 1/2 inch per foot.

2.5 GYPSUM COVER BOARD:

A. 1/4 inch thick fire resistant gypsum board decking with inorganic glass mat facers and a water resistant core, formulated in 48 x 96 inch square edge boards, UL Class A, meeting ASTM C-1177, manufactured under the trade name Dens-Deck.

2.6 INSULATION ADHESIVE:

A. Two component low rise polyurethane foam adhesive, installed with a mixing extruding Pace-Cart dispenser, or with a pleural heated foam rig, Firestone I.S.O. Adhesive intended for application at the temperatures that will be encountered.

B. Do not use twin cartridge adhesive except on very small isolated sections of roof.

2.7 EPDM

A. Unreinforced 60 mils thick, fire retardant, EPDM (Ethylene Propylene Diene Monomer) sheet membrane conforming to the following minimum physical properties.

PROPERTY	TEST METHOD	SPECIFICATION
Color	—	Gray/Black
Tensile Strength	ASTM D-412	1305 psi min.
Elongation	ASTM D-412	300% min
Tear Strength	ASTM D-624	150 lb/in min
Ozone Resistance	ASTM D-1149	No cracks,7 days/100 pphm/100ºF/50% strain
Heat Aging	ASTM D-573	1200 psi min@ 200% elongation/4 wks/240ºF
Brittleness Temperature	ASTM D-746	-49ºF
Water Vapor Permanence	ASTM E-96	2.0 perm max
Thickness	ASTM D-412	60 mils plus/minus 6 mils
Fire Retardant		UL Class A

2.8 RELATED MATERIALS

A. Cleaners, adhesives, sealants, caulking and fasteners furnished by the EPDM system Manufacturer and as listed below. Use low VOC adhesives and cleaners as required by regulations in effect at the time of application.

1. Stripping: 90 mil thick 5 inch and 9 inch wide self adhering flashing, consisting of 45 mils of semi-cured EPDM factory laminated to 45 mils of cured seaming tape.

2. Bonding Adhesive: High strength contact adhesive.

3. Splice Adhesive: High strength synthetic polymer based contact cement formulated specifically to splice EPDM sheets.

4. Lap Sealant: EPDM rubber based gun grade sealant.

5. Water Block Seal: One component low viscosity butyl rubber sealant.

6. Pre-Molded Pipe Flashing: Pressure sensitive prefabricated flashings with pre-applied adhesive.

7. Pourable Sealer: Two component, solvent free polyurethane based sealant.

8. Reinforced Perimeter Fastening Strips: .030 inch thick reinforced cured EPDM.

9. Seam Tape Primer: Synthetic rubber polymer based primer designed to clean and prime seam tape spice areas prior to installing the tape.

10. Seam Splice Tape: Nominal 30 mil thick cured polymer self adhesive tape with release paper carrier, 6 inches wide.

11. Plates and Bars: Galvanized and corrosion resistant specialty products.

12. Fasteners: #14 Fluorocarbon polymer coated heavy duty screws.

PART 3 - EXECUTION

3.1 GENERAL

A. Construct the new roofing system in a watertight, workmanlike manner, meeting the guarantee requirements specified herein; in strict accordance with the drawings and in conformance with the Manufacturer's requirements, except as enhanced in this specification.

B. Perform work in areas with roof mounted mechanical equipment, so the work coincides with equipment shutdown periods and does not affect building occupants. Temporarily cover and protect equipment openings, and windows adjoining the work area, with 6 mil fire retardant polyethylene, so dirt, dust and odors do not enter the equipment or building. Remove covers at the end of each workday, and as soon as roof work is complete.

C. Clean the surface on which roofing system components will be applied, of all laitance, dirt, oil, grease or other foreign matter which would in any way affect the quality of the installation.

D. Install roof system components on dry surfaces only. Do not install any items when weather conditions and outside temperatures are not suitable in accordance with the Manufacturer's recommendations.

E. Complete all work in sequence as quickly as possible so that as small an area as practicable is in the process of construction at any one time. Complete the entire area of work begun each day, the same day, and make all exposed edges watertight at the end of each day's work.

3.2 SUBSTRATE INSPECTION

A. Remove existing roofing, insulation, flashings, underlayment material and the vapor barrier as indicated, and carefully check the existing deck. To be an acceptable surface for the new roofing system, it is to be well secured to the underlying structure and not rotted or otherwise deteriorated.

B. Immediately notify the Architect and Owner by telephone and in writing if defects in the substrate are discovered.

C. Maintain the building watertight in the interim, but do not proceed with the installation of new roofing until defects have been corrected.

3.3 DECK REPAIR & REPLACEMENT

A. Refasten loose sections of steel deck using self drilling / tapping screws as Base Bid work

B. Steel deck replacement:

1. Alert the Owner and Architect if deteriorated steel decking is encountered, maintain the building watertight in the interim, and obtain direction before continuing with the work.
2. Remove damage decking across the entire width of individual sections by a length equal to a minimum of two joist bays.
3. Install new deck of thickness, gauge and cross section configuration to match existing. New steel deck shall be galvanized.
4. Fasten new deck to the joists with #12 screws spaced 6 inches on center in each joist.
5. Stitch side seams of steel deck with #10 screws spaced 24 inches apart.

3.4 PRIMER & VAPOR BARRIER

A. Install asphalt primer on concrete deck surfaces and allow it to dry before installing the vapor barrier.

1. Apply the primer only after new concrete has cured for at least 21 days, and when the concrete is dry.
2. Do not thin the primer.

B. Torch apply the vapor barrier to fully adhere it to the primer deck surface. Overlap end laps 6 inches, overlap ply lines 3 inches, and turn the vapor barrier up at perimeter blocking, curbs and change in elevation walls.

C. Post an English speaking fire watch employee, with a cell phone, on the roof when torch work occurs, and for 1 hour after it finishes each day.

3.5 INSULATION AND COVER BOARD

A. Install tapered insulation neatly cut at all miters and transitions. Do not lace corner boards.

B. Install insulation with joints offset between rows and layers a minimum of 12 inches. Cut insulation to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.

C. Fasten all layers of insulation only to the top flute of steel decks with screws and discs which penetrate through the deck a minimum of 3/4 inch and a maximum of 1-1/2 inches.

1. Install 16 fasteners per 4 by 8 foot insulation board in the field of the roof.
2. Install 28 fasteners per 4 by 8 foot insulation board in 8 foot wide perimeter zones.
3. Install 32 fasteners per 4 by 8 foot insulation board in 8 foot square corner zones.

D. Install all layers of insulation over the vapor barrier on concrete decks in low rise polyurethane foam adhesive.

E. Install gypsum cover board over the insulation using foam adhesive, with joints offset between the insulation and cover board a minimum of 12 inches. Cut gypsum cover board to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.

F. Install foam adhesive in accordance with the Manufacturer's recommendations and to achieve the specified minimum uplift resistance.

1. Install 1/2 inch diameter adhesive beads spaced 12 inches on center in the field of the roof.
2. Install 1/2 inch diameter adhesive beads spaced 6 inches on center in 8 foot wide perimeter zones.
3. Install 1/2 inch diameter adhesive beads spaced 4 inches on center in 8 foot square corner zones.
4. Place 5 gallon pails half full of gravel or concrete on the insulation and gypsum cover board to hold it firmly in position while the low rise foam adhesive sets. Position the pails no more than 24 inches apart in all directions.

3.6 EPDM

A. Position the EPDM roofing over the substrate without stretching it, and allow it to relax approximately one hour before adhering it to the substrate or forming the seams.

B. Position adjoining sheets in the same manner lapping the edges about 7 inches.

C. Fully adhere the EPDM to the substrate with bonding adhesive.

1. Open each can of adhesive and stir it with an electric paddle mixer for at least 5 minutes before applying the adhesive. Re-stir adhesive that isn't used within two hours of initial mixing.
2. Do not punch holes in cans of adhesive and use them in a "Better Spreader" without first opening the cans to mix them.
3. Replace used roller covers each day; discard covers after each days use.
4. Allow bonding adhesive to dry to the touch before joining the EPDM to the substrate.
5. Roll the EPDM onto the dried bonding adhesive and immediately rub it vigorously with a soft bristle broom to ensure complete adhesion.

D. **Roofing installed over improperly applied adhesive, and roofing installed with blisters, ridges, mole runs and similar deficiencies shall be removed and replaced at the Contractor's expense.**

3.7 SPLICING

A. Form all EPDM roof splices with 6 inch wide seam tape.

1. Fold the top sheet back about 7 inches. Clean both mating surfaces using clean rags with splice wash.
2. Scrub a smooth coat of QuickPrime to both mating surfaces, with long strokes obtaining complete coverage, using approximately 1 gallon per 225 square. Do not allow the QuickPrime to glop, streak or puddle. Allow it to dry to the touch before installing the seam tape.
3. Install the seam tape on the bottom sheet of EPDM roofing, using guide marks to position it so 1/8 inch minimum and 1/2 inch maximum will be exposed out of the seam when the seam is complete.
4. Roll and allow the top sheet to fall freely into place without stretching or wrinkling it.
5. Pull the splice tape release paper from within the seam area and neatly mate the seam using hand pressure to rub the membrane together.
6. Immediately roll the splice with a 2 inch wide roller, using positive pressure, toward the outer edge of splice.
7. Install uncured EPDM surface patches with rounded corners, over all T-Seam intersections.

8. Install 5 inch uncured EPDM stripping over any seam where the tape is exposed less than 1/8 inch or more than 1/2 inch.

3.8 PERIMETER FASTENING

A. Secure the EPDM roof at the perimeter of each section, and at eaves, penetrations, expansion joints and slope changes greater than 1 inch in 12 inches. Secure discs through the membrane or adhere it to continuous reinforced EPDM fastening strips. Fasten the discs and EPDM fastening strips 12 inches on center.

3.9 FLASHING

A. Utilized cured EPDM for all flashings; utilize self-curing EPDM at corners and angle changes only where required by the Manufacturer.

1. Form flashing splices, and the splice between the flashing and main roof sheet with 7 inch seam tape.
2. Adhere the flashing to vertical surfaces with bonding adhesive.
3. Fasten the top edge of all flashings, positioning the fasteners 12 inches on center, to be covered by the cap flashing.

B. Install premolded pipe flashings wherever possible. Where premolded pipe flashings cannot be installed, use field wrapped flashings. Install pitch pockets as a last resort.

C. Remove existing pipe flashings and Kennedy type couplings and extend the vent pipes to finish a minimum of 18 inches above the roof surface.

3.10 MISCELLANEOUS

A. Provide any miscellaneous roofing, flashing, caulking, and metal work needed to leave the work complete and entirely watertight, neatly and carefully executed in a thorough and workmanlike manner.

B. Mechanical and electrical work shall be performed by mechanics skilled and licensed in these trades. Provide new material, couplings, transition pieces, blocking, fasteners and the like needed to complete the work.

3.11 CLEANING, PROTECTION AND WATERTIGHTNESS

A. Conduct an inspection of the interior and exterior of the existing building and grounds, and submit a written report with photos to document any pre-existing leakage or damage, prior to performing any work.

B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leakage or damage which was not documented in the Contractor’s report, or repaired to the Owners satisfaction at the Contractor’s expense.

C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather which may occur unexpectedly. Make all work areas watertight at the end of each day's work.

E. Frequently clean up all refuse, rubbish, scrap materials and debris so the work site presents a neat, orderly and workmanlike appearance.

F. Carefully clean the roof to remove all residual debris when work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

3.12 ROOF INSPECTIONS BY MANUFACTURER

A. Arrange for the roofing Manufacturer, or his authorized representative, to make a minimum of five inspections in accordance with the following schedule and submit a written report of each inspection to the Architect within one week following each inspection:

1. First inspection during the first two days of new roof installation.
2. Second inspection when roofing is approximately one third complete.
3. Third inspection when roofing is approximately two thirds complete.
4. Fourth inspection when all roofing and flashings are installed.
5. Final inspection at the completion of all work.

B. Provide 48 hours advance written notice to the Architect, so he may have a representative attend the inspections.

C. Payment requisitions will not be reviewed nor approved until the inspection reports are received.

3.13 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with the Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing until removed from the site.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 52 23

SECTION 07 62 00 - SHEET METAL FLASHINGS & SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of Sheet Metal Flashings & Specialties, shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Sheet metal work that is compatible with the roofing systems specified, including cap and through wall flashings, hook strips, fascia, gravel stops, copings, gutters, leaders, valleys, flat and standing seam panels, ridges and miscellaneous flashings.

B. Related Requirements

1. Section 06 10 00 – Rough Carpentry
2. Section 07 53 23 – EPDM Roofing
3. Section 07 22 00 – Roof Accessories

1.2 CODE APPROVAL REQUIREMENTS

A. Fabricate and install roof perimeter flashings that comply with the NY State Uniform Fire Prevention and Building Code and ANSI/SPRI ES-1 requirements.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. A firm (Installer) with not less than 5 continuous years experience performing Sheet Metal work similar to that required for this project, employing personnel skilled in the specified work.
    a. The Installer shall directly employ the personnel performing the work of this section.
    b. The Installer shall have a full time supervisor/foreman on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience in work similar in nature and scope to this project and speak fluent English.
2. The Installer shall provide a reference list of at least three projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
    a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner’s name - contact person - phone number and address and the Architect’s name - contact person and phone number.
    b. The Installer shall provide the reference list prior to contract award if requested.

B. Material Quality:

1. Obtain each product from a single Manufacturer which has manufactured the same product in the United States of America for not less than 5 continuous years.
2. Obtain copper and pre-finished sheet metal items from the same mill run to maintain consistent color hue and surface finish.

C. Pre-Work Conference: Meet at the project site approximately one week prior to starting work, with the Architect, Owner and other representatives concerned about the work, to discuss the following:

1. How sheet metal work will be coordinated with the installation of the vapor barrier, thermal barrier, insulation, cover board, roofing, flashings, roof accessories and other items to provide a watertight installation.
2. Generally accepted industry practice, the Manufacturer's instructions for handling and installing his products, and specified work requirements.
3. The condition of the substrate (deck), curbs, penetrations and other preparatory work needed.
4. Submittals, both completed and yet to be completed.
5. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
6. A schedule for Manufacturer and Architect inspections.

1.4 SUBMITTALS

A. Submit the following items far enough in advance to obtain approval prior to performing any work:

1. Pre-work site inspection report with photos to document conditions before work starts.
2. Shop drawings, or 2 foot long samples, for each sheet metal item, to show how it relates and fits on adjoining masonry and wood blocking assemblies, and with the roof, stripping, and flashings.
3. A 6 inch square piece of each type of sheet metal to show surface finish, texture and color.
4. Literature for each type of sheet metal, sealant and fastener, including the Manufacturer's instructions which show how to install the items, and form and seal joints.
5. A sample of the Contractor’s guarantee form.

B. Technical submittals shall be prepared and made by the firm that will perform the actual work.

C. Payment requisitions will not be processed until all submittals are received and approved.

1.5 JOB MOCK-UPS

A. After the submittals are approved, prepare in actual job locations, mock-ups of cap and through wall flashings, hook strips, drip edges, fascia, gravel stops, and all other items of sheet metal and related work, for inspection and approval by the Architect.

B. Construct each mock-up of two full lengths of metal, fastened, connected and stripped-in to the related roofing system, to show the following:

1. Type, gauge, color, cross-sectional dimensions and shape, and joint and mitering techniques.
2. Related masonry work, wood blocking, and the attachment techniques and fasteners for all wood and metal components.
3. Other sheet metal related materials and their installation techniques to fully define the detailing of each mock-up.

C. The purpose of each mock-up is to establish the minimum standard of materials and workmanship, and to assure that completed work which matches the mock-ups will be fully functional and serve the purpose for it has been designed.

D. Approved mock-ups may be left in place and incorporated into the permanent installation. Rejected mock-ups shall be removed and replaced until approved.

E. Do not purchase or fabricate sheet metal items until mock-up installation, inspection and approval are completed and approval is documented in writing.

1.6 GUARANTEE

A. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:

1. Defective work includes but is not limited to the following types of failure: leakage, adhesive separation, delamination, lifting, loosening, splitting, cracking, and undue expansion.
2. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense.
3. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.

B. The Guarantee shall be issued no more than 30 days before the satisfactory completion of punch list work.

C. The Contractor’s Surety Company may add a rider to the Performance Bond which clarifies that Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor’s Guarantee.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Copper sheet: ASTM B370, 99.0 % pure copper, thickness 16 ounces per square foot. Use copper for all metal items not otherwise indicated

B. Zinc-Tin coated copper: copper sheet, coated on both sides, with a smooth uniform coating of zinc and tin, base metal weight 16 ounces per square foot, cold rolled temper, available as FreedomGray Copper by Revere.

C. Solder:

1. 50-50 tin and lead for plain copper, supplied in one pound bars with the alloy mixture stamped into the bar by the Manufacturer.
2. Lead free / or pure tin solder for zinc-tin coated copper, Number 497 by Johnson Manufacturing.

D. Flux:

1. Water-Soluble Liquid Flux, Kester #3345 for iron soldering of brass and copper.
2. Tin-bearing flux such as “Flux-N-Solder E127 with pure tin” by Johnson Manufacturing.

E. Factory Fabricated Roof Edge System: Extruded aluminum anchor bars secured with #9 stainless steel screws spaced 12 inches on center and .050 inch thick Kynar 500 prefinished aluminum trim covers, independently tested to comply with the ANSI / SPRI ES-1 Wind Design Guide.

F. Fasteners: stainless steel, or to match the sheet metal being fastened.

G. Glass Cloth: open mesh glass fabric coated on each side with plasticized asphalt as manufactured by Karnak Corporation or equal.

H. Asphalt cement: Federal Specification SS-C-153B, Type 1, asbestos free grade.

I. Exterior mounted leaders and straps: .027 inch thick rectangular corrugated aluminum leaders factory finished with baked acrylic enamel. Fasten each leader with 1/16 inch thick by 1 inch wide straps spaced 7 feet on center.

J. Sealant: High performance, solvent free, formulated and moisture curing silyl-terminated polyether sealant, ASTM C-920, Type S, Grade NS, Class 25, NovaLink construction sealant by ChemLink, color as selected.

PART 3 - EXECUTION

3.1 GENERAL

A. Accurately reproduce the details and design shown, and form profiles, bends and intersections, sharp, true and even. Fabricate sheet metal in the shop whenever possible, and form joints, laps, splices and connections to shed water and condensation in the direction of flow.

B. Provide any miscellaneous flashing and sheet metal work not shown on the drawings but otherwise needed to leave the project complete and entirely watertight, neatly and carefully executed in a thorough and workmanlike manner.

3.2 INSPECTION

A. Examine surfaces to receive work of this section and report any defects to the Owner and Architect.

3.3 INSTALLATION

A. Fabricate and install copper work in accordance with the current edition of "Copper and Common Sense" as published by the Revere Copper and Brass Company, unless otherwise indicated.

1. Form all joints, except loose locked sealant filled expansion joints, to overlap 2 inches.
2. Secure the joints with rivets spaced 1 inch on center positioned about 1/2 inch from the top edge of the joint, then sweat solder the joint.
3. Use solder only to fill and seal the joint, not for mechanical strength. Form soldered joints continuous, strong and free from defects, with well heated soldering irons. Do not use open flame torches for soldering.
4. Clean soldered joints daily, immediately after soldering, by washing them with soap and water applied with a soft bristle brush, then rinsing with clear water.

B. Securely fasten and anchor all work, and make provisions for thermal expansion. Submit details of expansion joints for approval. Install fasteners through one edge of metal only, use a hook strip on the other edge.

C. Use stainless steel pin Zamac type nail-in fasteners, or stainless steel screws and washers with neoprene inserts where fasteners will be exposed.

3.4 CAP FLASHINGS

A. Install new copper cap flashings built into masonry walls properly joined to all related materials in a watertight manner.

1. Solder all joints in the new cap flashing, except form 2 inch wide flat locked sealant filled expansion joints a maximum of 32 feet on center.
2. Form the flashing to turn up 2 inches inside the wall and finish with a hem on the bottom exposed edge.
3. Fasten the top edge of the cap flashing to the back up masonry 12 inches on center.
4. Install the new cap flashing under flexible type wall flashings where possible. Where it is not possible to lap the new cap flashing under an existing wall flashing, install a ply of glass cloth set in and coated with asphalt cement to connect the new cap flashing to the existing wall flashing.
5. In the absence of an existing wall flashing, or at a solid masonry wall, turn up the new cap flashing 2 inches behind the first wythe of masonry.
6. Install new cap flashings where shown on the drawings, and at a height of 10 to 12 inches above the roof surface.

B. Install new aluminum cap flashings on existing and new skylight and equipment curbs.

1. Form the cap flashing to extend 2 inches under the equipment or skylight, 4 inches over the base flashing, and finish with a 1/2 inch hem on the bottom edge.
2. Install a 1/2 inch thick by 2 inch wide continuous foam gasket between the cap flashing and mechanical equipment or skylight. Do not set the equipment or skylight in sealant.
3. Secure the equipment or skylight to the curb with stainless steel screws spaced 12 inches on center.

3.5 DRIP EDGES

A. Fabricate drip edges to extend 1-1/2 inches past the roof edge, and turn down to ensure water cannot track back and run down the fascia. Secure the drip edge with roofing nails along the top edge, spaced 4 inches apart along the raw metal edge. Form joints in the drip edge with 6 inch wide concealed under plates which duplicate the profile of the drip edge. Set the underplates in a full bed of sealant.

3.6 HOOK STRIPS

A. Form continuous hook strips with locks that engage the superimposed trim piece a minimum of 3/4 inch, and to cover the entire underside edge of the wood blocking and neatly extend to the building wall.

B. Fasten hook strips along their bottom edge, just above the 45 degree bend, with nails spaced 4 inches on center into underlying wood blocking; Zamac type nail-in type fasteners spaced 8 inches on center into masonry surfaces, or screws spaced 8 inches on-center into sheet metal surfaces.

3.7 ROOF EDGE SYSTEM

A. Install a factory fabricated roof edge system on all roof eaves.

1. Extend the EPDM roof down the face of the fascia trim, so it stops just short of the bottom edge of the anchor bar.
2. Install the anchor bar straight, level and true, set in a full bed of sealant, and secure the bar with #9 by 2 inch long stainless steel screws spaced no more than 12 inches apart.
3. Pre-drill screw holes in the underlying metal fascia trim, and where extra fasteners are needed at corners and special conditions.
4. Install color matching under plates at each joint in the roof edge trim; set the under plates in a full bed of sealant.

3.8 CLEANING, PROTECTION AND WATERTIGHTNESS

A. Conduct an inspection of the interior and exterior of the building and grounds, and submit a written report with photos to document any pre-existing leakage or damage, prior to performing any work.

B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leakage or damage which was not documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.

C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather which may occur unexpectedly. Make all work areas watertight at the end of each day's work.

E. Frequently clean up all refuse, rubbish, scrap materials and debris so the work site presents a neat, orderly and workmanlike appearance.

F. Carefully clean the roof to remove all residual debris when work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

3.9 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with the Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing until removed from the site.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work of Roof Accessories, as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Aluminum smoke hatches and safety screens.
2. Aluminum access hatches and safety rails.
3. Galvanized steel roof access ladders and stairs.
4. Roof walkway pads and concrete pavers.

B. Prepare, prime and paint all ferrous metal rooftop items.

C. Related Requirements

1. Roof Related Masonry - Section 04 50 00
2. Rough Carpentry - Section 06 10 00
3. EPDM Roofing - Section 07 53 23
4. Sheet Metal Flashing & Specialties - Section 07 62 00

1.2 QUALITY ASSURANCE

A. Installer Qualifications:

1. A firm (Installer) with not less than 5 continuous years experience performing Roof Specialty work similar to that required for this project, employing personnel skilled in the specified work.
    a. The Installer shall directly employ the personnel performing the work of this section.
    b. The Installer shall have a full time supervisor/foreman on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience in roofing work similar in nature and scope to this project, and speak fluent English.
2. The Installer shall provide a reference list of at least three projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
    a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
    b. The Installer shall provide the reference list prior to contract award if requested.

B. Material Quality: Obtain each product from a single Manufacturer, which has manufactured the same product in the United States of America for not less than 5 continuous years.

C. Pre-Work Conference: Meet at the project site approximately one week prior to starting work, with the Architect, Owner and other representatives concerned about the work, to discuss the following:

1. How roof accessory work will be coordinated with the installation of the vapor barrier, insulation, cover board, roofing, flashings, and other items to provide a watertight installation.

2. Generally accepted industry practice, the Manufacturer's instructions for handling and installing his products, and specified work requirements.
3. The condition of the substrate (deck), curbs, penetrations and other preparatory work needed.
4. Submittals, both completed and yet to be completed.
5. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
6. A schedule for Manufacturer and Architect inspections.

1.3 SUBMITTALS

A. Submit the following items far enough in advance to obtain approval prior to performing any work:

1. Pre-work site inspection report with photos to document conditions before work starts.
2. Manufacturer’s installation instructions and technical data sheets for each item. Material sample submittals are not needed unless requested to show color and texture.
3. Samples of the Contractor’s and Manufacturer’s guarantee/warranty forms.
4. Technical submittals shall be prepared and made by the firm that will perform the actual work.
5. Payment requisitions will not be processed until all submittals are received and approved.

1.4 GUARANTEE

A. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:

1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.
2. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense.
3. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.

B. The Guarantee shall be issued no more than 30 days before the satisfactory completion of punch list work.

C. Guarantee coverage shall include the removal and replacement of related material installed as part of the original work, if removal is needed to make warranty repairs.

D. Guarantee coverage may be cancelled, for the affected portion of the work, if the work is damaged by winds in excess of 72 mph, by hail, lightning, insects or animals, by failure of the structural substrate, by exposure to harmful chemicals, by other trades or vandalism, or if the Owner fails to maintain the roof and specialties in accordance with, or makes roof alterations contrary to, the Manufacturers printed recommendations.

E. Guarantee coverage shall be reinstated, for the remainder of the original term, if the Owner restores the specialty item to the condition it was in prior to the damage occurring.

F. The Contractor’s Surety Company may add a rider to the Performance Bond which clarifies that Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor’s Guarantee.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the Manufacturer's standard units, modified as necessary to comply with the specified requirements. Fabricate each unit in a shop to the greatest extent possible.

B. Aluminum Sheet: ASTM B 209 alloy 3003, tempered for forming and performance; mill finish, except as otherwise noted.

C. Extruded Aluminum: Standard extrusions alloy 6063-T52; 0.078 inch minimum thicknesses for primary framing and curb member legs, 0.062 inch thickness for secondary framing and covers; mill finish, except as otherwise indicated.

D. Insulation: Rigid fiber glass boards where encapsulated inside metal skirts, rigid isocyanurate where covered with roof flashings on the exterior of curbs.

E. Wood Nailers: Dimension grade Douglas Fir, not less than 1-1/2 inches thick.

F. Fasteners: Nonmagnetic stainless steel or hot dipped galvanized steel, to match the finish of the material being fastened.

G. Gaskets: Tubular neoprene or polyvinyl chloride, or block sponge neoprene.

H. Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

2.2 (NOT USED)

2.3 ALUMINUM SMOKE VENT HATCHES & SAFETY SCREENS

A. UL listed hatches constructed with welded 11 gauge mill finish aluminum covers and extended curbs with integral vent louvers complete with counter flashings, 1 inch cover insulation covered by a metal liner, a neoprene draft seal, 3-1/2 inch deck flanges, an inside handle, and tamper resistant hinges contained within the hatch. Provide manual, fusible link and electric solenoid releases, as manufactured by The Bilco Company in sizes needed to match the deck openings.

B. Safety Screens: Galvanized 4 inch by 4 inch 6 gauge welded wire cages and 1/4 inch thick 1-1/2 by 1-1/2 steel perimeter angle support frames.

2.4 ALUMINUM ACCESS HATCHES & SAFETY RAILS

A. Hatches constructed of welded 11 gauge mill finish aluminum, with 12 inch high curbs with integral cap flashings, heavy pintle hinges, compression spring operators, a spring latch with a turn handle, an interior padlock hasp, and stainless steel hardware, as manufactured by the Bilco Company, in the sizes needed to fit the existing openings, and as shown.

B. Safety rails mounted to the exterior curb, above the flashing, constructed of pultruded fiberglass reinforced polymer treated with UV inhibitors, “safety yellow” color, with 1/4 inch thick galvanized steel mounting brackets, aluminum hinges and a stainless steel torsion rod hinge, Bilco Bil-Guard Hatch Railing System.

2.5 GALVANIZED STEEL ROOF ACCESS LADDERS AND STAIRS

A. Fabricate ladders from 1-1/4 inch inside diameter steel pipe rails, spaced 22 inches apart, and 3/4 inch solid steel rebar rungs spaced 12 inches on center. Fit the rungs into drilled holes in the centerline of the rails, weld and grind the welds smooth. Hot dip galvanize coat the ladder and mounting brackets after fabrication. Install with Type 316 stainless steel hardware.

2.6 ROOF WALKWAY PADS AND CONCRETE PAVERS

A. 2 inches thick, 24 inches by 24 inches precast concrete pavers, natural buff color and finish, minimum 7500 psi compressive strength as manufactured by Hanover Architectural Products.

B. 30 inches by 30 inches hard rubber black walkway pads manufactured by Firestone.

2.7 PAINT AND PRIMER

A. Alkyd base rust inhibiting exterior primer and high gloss finish paint for ferrous metal surfaces as manufactured by Benjamin Moore or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Field measure existing openings. Comply with manufacturer's instructions and recommendations. Coordinate with the installation of roof deck, other substrates to receive specialty units, vapor barriers, roof insulation, roofing and flashing to ensure that each element of the work performs and fits properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

3.2 ALUMINUM SMOKE AND ACCESS HATCHES

A. Remove the existing hatch assemblies; use care not to damage the roof deck, curb liner or alarm detector and wiring.

B. Block solid under the curbs to match the insulation thickness.

C. Install new curb flashings and restore the existing curb liner to match the original construction.

D. Position and orient access hatches for proper egress from roof ladders. Connect and test all smoke vent hatches to the satisfaction of the Owner and applicable inspection agency.

E. Install new safety screens to fit inside the smoke hatches only. Wire brush, prime and install two finish coats of paint on the screens prior to installation. Fasten the screens with 5/16 inch diameter lag bolts / expansion bolts / epoxy set bolts spaced 12 inches on center around the entire perimeter of the screens.

3.3 GALVANIZED STEEL ROOF ACCESS LADDERS

A. Install ladders at the interior and exterior locations shown. Support and secure each ladder at the top and bottom and at intermediate points spaced a maximum of 5 feet on center. Use bolted steel brackets, anchored with 1/2 inch diameter stainless steel epoxy set bolts. Space the ladders to provide 7 inches of toe clearance. Extend the rails 42 inches and goose-neck form them to provide additional support at the top of the ladder.

3.4 ROOF WALKWAY PADS AND CONCRETE PAVERS

A. Install hard rubber walkway pads to provide a path 2-1/2 feet wide where shown, and at all roof access points, i.e., doors, ladders and hatches, under concrete pavers used for conduit and pipe supports, and around all HVAC equipment.

1. Adhere each pad with five self adhesive strips

B. Install concrete pavers spaced 5 feet on center to support roof top conduits and pipes.

3.5 PAINTING

A. Scrap and wire brush ferrous metal roof top equipment, ladders, access doors and frames (both sides) and the vent pipes to remove loose and peeling paint and surface rust.

B. Install one coat of primer and two finish coats of paint using a brush or roller. Wait 24 hours for each coat of paint top dry before applying the next coat.

3.6 MISCELLANEOUS

A. Provide and install any sealants needed, where shown or required.

B. Perform mechanical and electrical work using skilled and licensed tradesmen.

C. Provide new material, couplings, transition pieces, blocking, fasteners and the similar accessories needed to complete the work.

3.7 CLEANING, PROTECTION AND WATERTIGHTNESS

A. Conduct an inspection of the interior and exterior of the building and grounds, and submit a written report with photos to document any pre-existing leakage or damage, prior to performing any work.

B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leakage or damage which was not documented in the Contractor’s report, or repaired to the Owners satisfaction at the Contractor’s expense.

C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather which may occur unexpectedly. Make all work areas watertight at the end of each day's work.

E. Frequently clean up all refuse, rubbish, scrap materials and debris so the work site presents a neat, orderly and workmanlike appearance.

F. Carefully clean the roof to remove all residual debris when work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

3.8 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with the Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing until removed from the site.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 72 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

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 performance criteria, materials, production, and erection of penetration firestopping for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all penetration firestopping as required by the this section, schedules.

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.3 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.

1.4 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.

1.5 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 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."

D. Preinstallation Conference: Conduct conference at Project site.

1.6 REFERENCED STANDARDS

A. American Society for Testing and Materials (ASTM).

1. E 814 – Standard Method of fire Tests of Through Penetration Fire Stops.
2. E 119 – Methods of Fire Tests of Building Construction and Materials.
3. E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
4. E 136 – Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F.
5. E 1399 – Cyclic Movement and Measuring Minimum and Maximum Joint Widths.
6. E 1966 – Test method for Resistance of Building Joint.
7. E 2174 – Standard practice for On-Site Inspection of Installed Firestops.
8. E 05.11.14 – Standard Test method for Determining the fire endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA): ASTM number pending draft approval.

B. Underwriters Laboratories, Inc. (UL).

1. UL 1479 – Fire Tests of Through Penetration fire Stops.
2. UL 263 – Fire Test of Building Construction and Materials.
3. UL 723 – Surface Burning Characteristics of Building Materials.
4. UL 2079 – Tests for Fire Resistance of Building Joint Systems.

5. UL "Fire Resistance Directory", current year, including but not limited to the following:

   a. For penetrations by uninsulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT):
      1) UL System: CAJ-1235, CAJ-1404, WL-1152.
   b. For penetrations by insulated, non-combustible items including steel pipe, cooper pipe, rigid steel conduit and electrical metallic tubing (EMT):
      1) UL Systems: CAJ-5222, CAJ-5250, CAJ-5251, WL-5171.
   c. For penetrations of PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems):
      1) UL Systems: CAJ-2401, CAJ-3185, CAJ-3199, CAJ-3234, WL-3118, WL-3179, WL-3199.
   d. For penetrations of combustible plastic pipe (open piping system):
      1) UL Systems: CAJ-2174, CAJ-2330, CAJ-2351, CAJ-2432, WL-2168, WL-2170, WL-2185, WL-2259.
   e. For penetrations by multiple combustible and/or non-combustible items:
      1) UL Systems: CAJ-8101, CAJ-8133, WL-8007.
   f. For large size / complex penetrations made to accommodate cable trays, multiple steel and cooper pipes, electrical busways in raceways:
      1) UL Systems: CAJ-1406, CAJ-1502, CAJ-4053, CAJ-6027, WJ6004, WL-1207, WL-2343, WL-4030, WL-6018.
   g. For penetrations by steel ducts:
      1) UL Systems: CAJ-7075, CAJ-7082, WJ-7045, WJ-7046, WL-7006, WL-7046, WL-7081, WL-7082.
   h. For fire-rated construction joints and other gaps:
      1) UL Systems: CEJ-296P, CEJ-302P.
   i. For openings between structurally separate sections of wall and floors:
      1) At the top of walls: UL systems: HWD-0107, HWD-0110, HWD-0257, HWD-0267, HWD-0299, HWD-0327, HWD-0266, HWD-0333, HWD-0334.

C. Factory Mutual (FM) Approval guide, current year.

D. National Fire Protection Association.

E. FICA "Manual of Practice".

F. International Firestop Council (IFC).

1.7 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.

1.8 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

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. Grace Construction Products.
2. Hilti, Inc.
3. Johns Manville.
4. NUCO Inc.
5. Passive Fire Protection Partners.
6. Specified Technologies Inc.
7. 3M Fire Protection Products.
8. Tremco, Inc.; Tremco Fire Protection Systems Group.
9. USG Corporation.

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, floor/ceiling assemblies and ceiling membranes of roof/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.

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. Flexible Firestop Sealant (For use where roof joists penetrate fire-rated walls): Acrylic based firestop sealant that provides movement capability in fire rated joint applications. Basis of Design: Hilti CP 606.

C. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. 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.

I. 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.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. 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

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. 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. The following schedules shall be completed by the Contractor and reviewed prior to submission to the Architect. The Table included shall be completed with each of the following categories of penetrating items:

1. Single uninsulated metallic piping and conduit.
2. Multiple uninsulated metallic piping and conduit.

3. Uninsulatted plastic piping and conduit.
4. Insulated metallic piping.
5. Insulated high temperature flues and exhaust pipes (boiler flues, generator exhausts insulated with calcium silicate or on the non-combustible insulation, etc.)
6. Cable tray.
7. Electric / telephone cable.
8. Bus duct.
9. Miscellaneous penetrations.

B. Complete the additional Tables for the following, using the format provided.

1. Blanks, voids, holes (including edge of slab).
2. Engineering judgments.
3. Ductwork engineering judgments.

3.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 84 13

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SECTION 07 84 46 - FIRE-RESISTIVE JOINT 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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work for fire resistive joint systems as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior storefront-wall/floor intersections.
3. Joints in smoke barriers.

1.3 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. Retain subparagraph below only after verifying that authorities having jurisdiction will accept modifications handled by method in subparagraph.

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.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

B. Product test reports.

1.5 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."

B. 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.

C. Pre-installation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

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: Ratings determined per ASTM E 1966 or UL 2079:

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Grace Construction Products.
b. Hilti, Inc.
c. 3M Fire Protection Products.
d. Tremco, Inc.; Tremco Fire Protection Systems Group.
e. USG Corporation.

C. Joints at Exterior Storefront-Wall/Floor Intersections: Rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

2. Basis of Design: Perimeter Fire Barrier System CEJ 127P (HI/JS 120-05) by Hilti, Inc.

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Grace Construction Products.
b. Hilti, Inc.
c. 3M Fire Protection Products.
d. Thermafiber, Inc.
e. Tremco, Inc.; Tremco Fire Protection Systems Group.
f. USG Corporation.

D. Joints in Smoke Barriers: Ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Grace Construction Products.
    b. Hilti, Inc.
    c. 3M Fire Protection Products.
    d. Tremco, Inc.; Tremco Fire Protection Systems Group.
    e. USG Corporation.

E. 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.

F. 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.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. 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 INSTALLATION

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. Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. 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.

D. 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.

3.2 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches 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.

3.3 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

3.4 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.

C. Floor-to-Floor, Fire-Resistive Joint Systems FRJS-1:

1. UL-Classified Systems: FF-D S-Insert four-digit number 0000-0999 1000-1999 2000-2999 3000-3999 4000-4999.

D. Wall-to-Wall, Fire-Resistive Joint Systems FRJS-2:

1. UL-Classified Systems: WW-D S-Insert four-digit number 0000-0999 1000-1999 2000-2999 3000-3999 4000-4999.

E. Floor-to-Wall, Fire-Resistive Joint Systems FRJS-3:

1. UL-Classified Systems: FW-D or S-Insert four-digit number 0000-0999 1000-1999 2000-2999 3000-3999 4000-4999.

F. Head-of-Wall, Fire-Resistive Joint Systems FRJS-4:

1. UL-Classified Systems: HW-D S-Insert four-digit number 0000-0999 1000-1999 2000-2999 3000-3999 4000-4999.
2. Intertek ETL SEMKO-Listed Systems:

G. Bottom-of-Wall, Fire-Resistive Joint Systems FRJS-5:

1. UL-Classified Systems: BW-D S-Insert four-digit number 0000-0999 1000-1999 2000-2999 3000-3999 4000-4999.

H. Wall-to-Wall, Fire-Resistive Joint Systems Intended for Use as Corner Guards FRJS-6:

1. UL-Classified Systems: CG-D S-Insert four-digit number 0000-0999 1000-1999 2000-2999 3000-3999 4000-4999.

I. Perimeter Fire-Resistive Joint Systems PFRJS-1:

1. UL-Classified Perimeter Fire-Containment Systems: CW-D S-Insert four-digit number 0000-0999 1000-1999 2000-2999.
2. Intertek ETL SEMKO-Listed, Perimeter Fire-Barrier Systems.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 07 84 46

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SECTION 07 92 00 - 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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work for joint sealants as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Architectural Sealants.
2. Sealant Primers for Nonporous Substrates.
3. Sealant Primers for Porous Substrates.

B. Related Sections:

1. Division 04 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 07 "Expansion Control" for building expansion joints, "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Division 08 "Glazing" for glazing sealants.
4. Division 09 "Gypsum Board" for sealing perimeter joints, "Tiling" for sealing tile joints,
5. "Acoustical Tile Ceilings**"** for sealing edge moldings at perimeters with acoustical sealant.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each kind of sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

G. Field-Adhesion Test Reports: For each sealant application tested.

H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. 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.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

G. Suitability for Contact with Food: Comply with 21 CFR 177.2600, where applicable.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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; 790
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. May National Associates, Inc.; [Bondaflex Sil 290] [Bondaflex Sil 728 NS].
d. Pecora Corporation; [301 NS] [311 NS] [890] [890FTS].
e. Sika Corporation, Construction Products Division; SikaSil-C990.
f. Tremco Incorporated; [Spectrem 1] [Spectrem 800].

B. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
b. Tremco Incorporated; [Vulkem 921] [Dymonic FC].

2.3 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

    a. Pecora Corporation; [AC-20 FTR] [AIS-919].
    b. USG Corporation; SHEETROCK Acoustical Sealant.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine joints for suitable conditions.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in unit masonry.
    d. Joints in dimension cast stone cladding.
    e. Joints in glass unit masonry assemblies.
    f. Joints between metal panels.
    g. Joints between different materials listed above.
    h. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    i. Control and expansion joints in ceilings and other overhead surfaces.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
3. Urethane Joint Sealant: Single component, nonsag, Class 100/50.
4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical joints on exposed surfaces of interior unit masonry, concrete walls and] partitions.
    e. Joints on underside of plant-precast structural concrete planks.
    f. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    g. Other joints as indicated.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

    a. Acoustical joints where indicated.
    b. Other joints as indicated.

2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

3.8 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 07 92 00

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SECTION 07 95 00 - EXPANSION CONTROL

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. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work for expansion control as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

1. Interior floor wall ceiling expansion control systems.
2. Exterior wall expansion control systems.

B. Related Requirements:
1. Division 03 for concrete work
2. Division 05 for structural and non-structural metal work
3. Section 07 84 46 Fire-Resistive Joint Systems
4. Section 07 92 00 Joint Sealants
5. Section 07 53 23 EPDM Roofing
6. Section 07 62 00 Sheet Metal Flashing and Specialties
7. Section 07 72 00 Roof Accessories
8. Division 09 for interior wall and floor work

1.3 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches (150 mm) long in size.

C. Samples for Initial Selection: For each type of expansion control system indicated.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches (150 mm) long in size.

E. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion control system.
2. Expansion control system location cross-referenced to Drawings.
3. Nominal joint width.
4. Movement capability.
5. Classification as thermal or seismic.
6. Materials, colors, and finishes.
7. Product options.
8. Fire-resistance ratings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
2. Component Importance Factor is 1.5.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

A. Locations: Between existing Salzmann Building and new East and West Wing Additions and between existing Salzmann Building and new Entry Addition.

B. Basis-of-Design Product: Subject to compliance with requirements, provide products by MM Systems Corporation, as indicated on the drawings or a comparable product by one of the following:

1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
2. Balco, Inc.
3. JointMaster/InPro Corporation.
4. Michael Rizza Company, LLC.
5. Construction Specialties, Inc.
6. Nystrom, Inc.

C. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

D. Interior Expansion Control System Requirement:

1. Floor to Floor - LASD
2. Floor to Wall – FSSTE
3. Wall to Wall – VSW
4. Wall to Corner – VSWL
5. Wall to Ceiling – VSWL
6. Ceiling to Ceiling – VSG
7. Wall to Soffit – VSWL

E. Finishes shall be compatible with adjacent materials or as designated in the drawings.

2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by MM Systems Corporation, as indicated on the drawings or a comparable product by one of the following:

1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
2. Balco, Inc.
3. JointMaster/InPro Corporation.
4. Michael Rizza Company, LLC.
5. Construction Specialties, Inc.
6. Nystrom, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Fire Resistance Rating: same as adjacent construction.

D. Exterior Expansion Control System Requirement with cover plates:
1. Wall to Wall – ESS
2. Wall to Corner – ESS

E. Exposed gasket: Extruded flexible gasket. Color as selected by Architect from manufacture's full range.

2.5 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.

D. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

E. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.

F. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.

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

H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
5. Install frames in continuous contact with adjacent surfaces.
    a. Shimming is not permitted.

6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.

E. Foam Seals: Install with adhesive recommended by manufacturer.

F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.

G. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

H. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

I. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet (15.2 m) or where indicated on Drawings.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 123.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.

2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 07 95 00

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work performed under this Section includes the performance criteria, materials, production, and erection of hollow-metal work for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all hollow-metal work as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities.

B. Related Requirements:

1. Division 08 **"**Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

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

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames with wall types in which they are installed. 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.

B. Coordinate installation of hollow-metal doors with existing hollow-metal door frames or existing wood frames. Contractor to verify existing frames are UL approved for fire-rated openings.
Provide survey of existing hollow-metal frame showing existing conditions including squareness and plumbness. All fire-rated doors to fit with maximum of 1/8” gap. Fabricate doors to fit existing opening. Door openings not meeting these requirements may require and engineering judgement for each varying condition. Furnish setting drawings, templates, and directions for installing hinges, locksets, panic hardware, closers, etc. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings**,** and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 8 by 10 inches (203 by 254 mm) to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

E. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, 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. Custom Metal Products.
4. Hollow Metal Inc.
5. National Custom Hollow Metal.
6. North American Door Corp.
7. Pioneer Industries, Inc.
8. Republic Doors and Frames.
9. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

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

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. Commercial Doors and Frames: NAAMM-HMMA 861. Provide 18 gauge doors, 16 gauge frames at openings 4'-0" or less in width; 14 gauge doors at openings larger than 4'-0" in width; 14 gauge frames at openings larger than 4'-0" in width. **No knock-down type frames are allowed** except where explicitly indicated as acceptable.

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 0.042 inch (1.0 mm).
    d. Edge Construction: Continuously welded with no visible seam.
    e. Core: Steel stiffened.

3. Frames:

    a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm) for door openings 48 inches (1219 mm) or less, or window frames; minimum thickness of 0.067 inch (1.7 mm)for door openings greater than 48 inches (1219 mm).
    b. Construction: Full profile welded.
    c. KD frames are not acceptable.

4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Commercial Doors and Frames: NAAMM-HMMA 861. Provide 16 gauge doors, 14 gauge frames. **No knock-down type frames are allowed** except where explicitly indicated as acceptable.

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: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.30 mm), with minimum G60 (Z180 or)A60 (ZF180) coating.
    d. Edge Construction: Continuously welded with no visible seam.
    e. Core: Steel stiffened.

        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 0.067 inch (1.7 mm), with minimum G60 (Z180 or)A60 (ZF180) coating.
b. Construction: Full profile welded.
c. KD frames are not acceptable.

4. Exposed Finish: Prime (Galvanized – zinc coating applied by hot dip process).

2.5 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 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.
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.

2.7 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. 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.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. 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.

H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

I. 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.

J. Glazing: Comply with requirements in Section 088000 "Glazing."

K. 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.

2.8 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (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 and temperature-rise 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 inverted closures, except provide flush closures at exterior doors 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 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:

        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.
6. 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.

7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45 degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.10 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

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 non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (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:

    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.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 08 11 13

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SECTION 08 12 55 – FIBERGLASS REINFORCED POLYESTER (FRP) DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The Work of this Section consists of the provision of all plant, labor, materials, equipment, testing and services necessary to complete the work for fiberglass reinforced polyester (FRP) flush doors with aluminum frames as shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction.

B. Related Requirements:
   1. Section 08 71 00 "Door Hardware" for door hardware.

1.3 COORDINATION

A. Coordinate anchorage installation for door 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 REFERENCES

A. AAMA 1503-98 - Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.

C. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.

D. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

G. ASTM D 543 - Evaluating the Resistance of Plastics to Chemical Reagents.

H. ASTM D 570 - Water Absorption of Plastics.

I. ASTM D 638 - Tensile Properties of Plastics.

J. ASTM D 790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

K. ASTM D 1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

L. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.

M. ASTM D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

N. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.

O. ASTM D 2583 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

P. ASTM D 5420 – Impact Resistance of Flat Rigid Plastic Specimens by Means of a Falling Weight.

Q. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.

R. ASTM E 84 - Surface Burning Characteristics of Building Materials.

S. ASTM E 90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

T. ASTM E 283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

U. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

V. ASTM E 331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

W. ASTM F 476 - Security of Swinging Door Assemblies.

X. ASTM F 1642-04 – Standard Test Method for Glazing Systems Subject to Air blast Loading.

Y. NWWDA T.M. 7-90 – Cycle Slam Test Method

Z. SFBC PA 201 - Impact Test Procedures.

AA. SFBC PA 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

BB. SFBC 3603.2 (b)(5) - Forced Entry Resistance Test.

CC. Compliance with the International Building Code® IBC 2603 (2012 and 2009)

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.27 psf. Door shall not exceed 0.58 cfm/ft^2.

C. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

D. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

E. Hurricane Test Standards, Single Door:
1. Uniform Static Load, ASTM E 330: Plus or minus 195 pounds per square foot.
2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
4. Large Missile Impact Test, SFBC PA 201: Passed.

F. Hurricane Test Standards, Pair of Doors with single point latching:
1. Uniform Static Load, ASTM E 330: Plus or minus 112.5 pounds per square foot.
2. Forced Entry Test, 300 Pound Load Applied, AAMA 1304: Passed.
3. Cyclic Load Test, ASTM E 1886: Plus or minus 75 pounds per square foot.
5. Large Missile Impact Test, ASTM E 1886: Passed.

G. Blast Test, Doors and Frames, ASTM F 1642-04, 6 psi / 41 psi-msec: Minimal Hazard.

H. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

I. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.

J. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.

K. Salt Spray, Exterior Doors and Frames, ASTM B 117: Minimum of 500 hours.

L. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 25.

M. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

N. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
1. Flame Spread: Maximum of 200, Class C.
2. Smoke Developed: Maximum of 450, Class C.

O. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
1. Flame Spread: Maximum of 25.
2. Smoke Developed: Maximum of 450.

P. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 14.0 foot-pounds per inch of notch.

Q. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 13,000 psi.

R. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

S. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.

T. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.

U. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 5420: 120 in-lb.

V. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

W. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

X. Chemical Resistance, ASTM D 543. Excellent rating.
1. Acetic acid, Concentrated.
2. Ammonium Hydroxide, Concentrated.
3. Citric Acid, 10%.
4. Formaldehyde.
5. Hydrochloric Acid, 10%
6. Sodium hypochlorite, 4 to 6 percent solution

Y. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.

Z. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.

AA. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.

BB. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.6 SUBMITTALS

A. Product Data: Submit door manufacturer’s product data, including description of materials, components, fabrication, finishes, and installation.

B. Submit six sets of factory shop drawings for the fabrication and installation of the Fiberglass Reinforced Polyester (FRP) Doors, Panels and Aluminum Frames, and associated components of the work. Include wall elevations at 1/2" scale, and half-sized detail sections of every typical composite member. Show anchors, joint system, expansion provisions, and other components not included in the manufacturer's standard data. Include field-verified dimensions and glazing details, and include Catalog cuts for all Finish Hardware.

C. Samples:

1. FRP Door: Submit corner samples of manufacturer's door showing face sheets, core, internal framing, finish, glazing, hardware, options, and accessories.

    a. The Architect reserves the right to require samples of typical fabricated sections, showing joints, exposing fastenings, (if any) quality of workmanship, hardware and accessory items, before fabrication of the work proceeds.

2. Framing: Submit manufacturer's corner samples of Door Perimeter Framing showing, glazing and finish.

3. Stile and Rail Door: Submit manufacturer's sample of doors showing, rails, framing, hardware, glazing and finish.

4. Color: Submit manufacturer's color chip samples of Standard of Classic and or Painted FRP Door and Panel Skins and either Standard or Optional Anodized or Painted finished at the Door Stiles and Rails, and Door Perimeter.

D. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

E. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

F. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

G. Warranty: Submit manufacturer's standard warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
2. Door and frame components from same manufacturer.
3. Evidence of a compliant documented quality management system.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.9 WARRANTY

A. Provide a written warranty, signed by Manufacturer, Installer and Contractor, agreeing to replace, at no cost to the Owner, any doors, frames or panels that fail in materials or workmanship, within the time period of acceptance, as indicated below.

1. Failure of materials or workmanship includes excessive deflection, faulty operation of entrances, deterioration of finish, or construction, in excess of normal weathering and defects in hardware, weather-stripping and other components of the work.

B. Warranty Period: Ten (10) years from approved date of substantial completion as determined by architect.

C. Limited Lifetime Warranty covering the following:
1. Failure of corner joinery.
2. Core deterioration.
3. Delamination or bubbling of door skin.

D. Factory Installed Hardware [for a period of ten (10) years]:
1. Hardware is installed in accordance with the hardware manufacturer's specifications and instructions.
2. Hardware is securely mounted and, in normal usage, will not separate from the door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Special-Lite Inc., PO Box 6 - Decatur, Michigan 49045, Phone: (800) 821-6531 Fax: (800) 423-7610 Web Site: www.special-lite.com. Subject to exact compliance with requirements, provide either the named product or one of the following:

B. Vista Wall, Inc. - Lincoln, Rhode Island

C. Tubelite, Inc. - Reed City, Michigan

D. Kawneer Co. – Norcross, Georgia

2.2 REGULATORY REQUIREMENTS

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

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Comply with the Building Code of New York State section 2603.4.1.7: Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2.3 FIBERGLASS REINFORCED POLYESTER (FRP) FLUSH DOORS

A. Basis of Design - Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

B. Door Opening Size: As indicated on the Drawings.

C. Door Construction:

1. Doors are to be 1-3/4" thick Special-Lite series SL-17 (FRP).

2. Stiles and Rails: Constructed of aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T5 alloy recovered from industrial processes, minimum/maximum 2-5/16-inch depth, joined with steel tie rods.

    a. Stile and Rails width greater than 2 5/16” is not acceptable.

3. Stiles to be tubular shape to accept hardware as specified.

4. Top and bottom rails to be extruded with legs for interlocking "rigidity weather bar."

5. Corners: Mitered.

    a. Butted Mortise and Tenon joints with rigid fillet welds is not acceptable.

6. Joinery to be 3/8" tie rods, top and bottom, bolted through an extruded spline, in both top and bottom rails with 3/16" mechanically fastened (screwed) reinforcing angles, and secured with hex type nuts. Welds, glue, or other methods are not acceptable.

7. All doors shall be pre-machined in accordance with templates from the hardware manufacturer. For surface applied hardware, doors shall have necessary reinforcement, including the attachment of RIVNUT blind bolt fasteners. With the exception of door closers and holders, which require field applications, doors are to be shipped with hardware attached.

8. Vision Lites: Provide glazed openings in doors as indicated, with manufacturer's standard aluminum moldings and stops, with removable stops on inside only. Glass to be “factory installed” for warranty purposes.

9. Face sheets to be locked in with extruded interlocking edges, which are the integral reglets of the Vertical and Horizontal rails permitting a flush appearance. No snap-on or screwed-on trim or caps will be accepted.

10. Core is to be of foamed in place Urethane foam *minimum* of 5 lbs. per cubic foot density. Minimum R Value of 9.

    a. All doors are to be properly reinforced for hardware prior to Urethane core foaming in door.

11. Face sheets for Fiberglass Reinforced Polyester (FRP) Doors are to be Kemlite SpecLite3®, 120" thick (sandstone grain texture) with color throughout. Color: As selected by Architect from manufacturer's full range of standard colors.

12. Unless otherwise noted, doors are to be supplied with an SL-82 Recessed Pull as manufactured by Special-Lite, Inc., (8-3/8" x 5-7/8" x 1-5/8"). Finish: To match face of door.

13. Concealed adjustable meeting stile astragal on pairs. Install door manufacturer's adjustable astragal with double pile and weather seal weatherstripping.

14. Meeting stiles, on pairs of doors with Mortise locks and flush bolts, are to have 70-91 beveled meeting stile extrusion with Nylon Pile weather stripping astragal.

15. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

16. Edge Capping: Screw applied edge capping is not acceptable.

2.4 MATERIALS

A. Aluminum Members:

1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:

1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.5 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:

1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.

D. Welding: Welding of doors or frames is not acceptable.

E. Fit:

1. Maintain continuity of line and accurate relation of planes and angles.
2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.6 ARCHITECTURAL PANELS

A. FRP Panels:

1. Model: SL-20 Insulated Architectural Panels with SpecLite3 FRP face sheets

B. Face Sheets:

1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
2. Texture: Sandstone Grain
3. Color: As selected by Architect from full range of standard colors.

C. Insulated SpecLite3 FRP Panels:

1. Insulated Panels: Two 0.120-inch minimum thickness sheets.
2. Core: Foamed polyurethane core of a minimum of 5 pounds per cubic foot density.
3. Form components to function as single unit.
4. R-Value: Minimum of 4.3 for 1-inch panels.

D. Class A Flame Spread and Smoke Developed Rating:

1. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.
2. Flame Spread, ASTM E 84: Maximum of 25.
3. Smoke Developed, ASTM E 84: Maximum of 450.

2.7 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:

1. Size and Type: As indicated on the Drawings.

2. Materials: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes, 1/8-inch minimum wall thickness.
3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
4. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
5. Caulking: Caulk joints before assembling frame members.
6. Joints:
   a. Secure joints with fasteners.
   b. Provide hairline butt joint appearance.
7. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
8. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
9. Hardware:
   a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
   b. Factory install hardware.
10. Anchors:
    a. Anchors appropriate for wall conditions to anchor framing to wall materials.
    b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
    c. Secure head and sill members of transom, side lites, and similar conditions.
11. Side Lites:
    a. Factory preassemble side lites to greatest extent possible.
    b. Mark frame assemblies according to location.

2.8 INSERT FRAMING SYSTEM

A. Model: SL-1030 Series

B. Insert frame, as indicated on the drawings, using integral stop fitted with weatherstripping.

C. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.

D. Hardware:

1. Pre-machine and reinforce insert frame members for hardware in accordance with manufacturer’s standards and hardware schedule.
2. Factory Install hardware.

E. Anchors:

1. Anchors of suitable type to fasten insert framing to existing frame materials. Minimum of five (5) anchors on jambs up to 7’4” height and three (3) anchors on headers. One (1) additional anchor for each additional foot of frame.

2.9 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Factory install hardware.

C. Hardware Schedule: As specified in Section 08 71 00

2.10 VISION LITES

A. Factory Glazing: 1/4" Laminated safety glass.

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Rectangular Lites:
1. Size: As indicated on the Drawings

2. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.

2.11 ALUMINUM FINISHES

A. Anodized Finish: Class I finish, 0.7 mils thick.

1. Clear 215 R1, AA-M10C12C22A41, Class I, 0.7 mils 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. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION – FRP DOORS

A. Install doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

E. Set thresholds in bed of mastic and backseal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 INSTALLATION – FRAMES

A. Install framing systems in accordance with manufacturer's instructions.

B. Install framing systems plumb, level, square, true to line, and weathertight, without warp or rack.

C. Anchor framing securely in place.

D. Tolerances: Install framing systems in accordance with the following tolerances:

1. Variation from Plane: Do not exceed 1/8 inch in 12 feet of length or 1/4 inch in any total length.
2. Offset from Alignment: Maximum offset from true alignment between 2 identical members abutting end to end in line shall not exceed 1/16 inch.
3. Diagonal Measurements: Maximum difference in diagonal measurements shall not exceed 1/8 inch.
4. Offset at Corners: Maximum out-of-plane offset of framing at corners shall not exceed 1/32 inch.

E. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

F. Set sills, door thresholds, and other members in bed of sealant or with joint fillers or gaskets to provide weathertight construction.

G. Install sill flashing to make frame watertight at sill.

H. Glass: Install glass indicated to be glazed into framing, and not preglazed, as specified in Section 08 80 00.

I. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

J. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.6 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.7 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.8 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

3.9 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 08 12 55

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SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Division 6 Section "Finish Carpentry"
   2. Division 8 Section “Hollow Metal Doors and Frames”

1.2 SUMMARY

A. This Section includes the following:
   1. Solid core doors with wood veneer faces.
   2. Factory finishing of flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.
   4. Louvers for flush wood doors.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of door, including details of core and edge construction, trim for openings, and factory-finishing specifications.

C. Shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for veneer matching and factory finishing and other pertinent data.
   1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light openings.

D. Samples for initial selection in the form of color charts consisting of actual materials in small sections for the following:
   1. Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.

E. Samples for verification in the form and size indicated below:
   1. Corner sections of doors approximately 12 inches square with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
   2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

A. Quality Standard: Comply with the following standard:
   1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grade of door, core, construction, finish, and other requirements.

B. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152; and are labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.

C. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.

B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

1.6 PROJECT CONDITIONS

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with the following requirements applicable to Project's geographical location:
   1. AWI quality standard Section 100-S-11 "Relative Humidity and Moisture Content."

1.7 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span, or do not conform to tolerance limitations of referenced quality standards.

   1. Warranty shall be in effect during the following period of time after date of Substantial Completion.
      a. Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering doors that may be incorporated in the Work include, but are not limited to, the following:
   1. Solid Core Doors:
      a. Algoma Hardwoods Inc.
      b. Buell Door Co.
      c. Eggers Industries, Architectural Door Division.
      d. Graham Manufacturing Corp.
      e. Haley Brothers, Inc.
      f. Ideal Wood Products, Inc.
      g. IPIK Door Co., Inc.
      h. Mohawk Flush Doors, Inc.
      i. Ragland Manufacturing Co., Inc.
      j. V-T Industries Inc.
      k. Weyerhauser Co.

2.2 INTERIOR FLUSH WOOD DOORS

A. Solid Core Doors for transparent stained Finish: Comply with the following requirements:
   1. Faces: Rotary Natural Birch.
   2. Grade: Premium.
   3. Construction: 5 plies.
   4. Core: Particleboard ANSI A208.1, GRADE LD-2 – PC-5 ME. Provide wood blocking in particleboard core doors as needed to eliminate through-bolting hardware. 5” toprail on doors and closers..
   5. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering.

2.3 VENEER MATCHING

A. Within Door Faces: Provide doors with the following veneer matching:
   1. Book matching.

B. Pairs and Sets: Provide pair matching and set matching for pairs of doors and for doors hung in adjacent sets.

C. Doors with Transoms (if any): Provide the following matching:
   1. Continuous matching.

2.4 FABRICATION

A. Fabricate flush wood doors to comply with following requirements:

1. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels:
   a. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-resistance-rated doors.
2. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.
   a. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.
   b. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

B. Transom and Side Panels (if any): Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
1. Fixed Transom Panels (if any): Fabricate fixed panels with solid lumber transom bottom rail and door top rail, both rabbeted as indicated. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

C. Openings (if any): Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
1. Light Openings: Trim openings with moldings of material and profile indicated.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard's requirements for factory finishing.

B. Finish wood doors at factory.

C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
1. Grade: Premium.
2. Finish: Manufacturer's standard finish with performance requirements comparable to either AWI System TR-6 catalyzed polyurethane.
3. Staining: As selected from manufacturer’s full line of standard stain colors.
4. Effect: Filled finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed 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.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation see Division 8 Section "Door Hardware."

B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to requirements of NFPA 80.
   2. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8 inch at jambs and heads, 1/16 inch per leaf at meeting stiles for pairs of doors, and 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch clearance from bottom of door to top of threshold.
   3. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.
   4. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
   5. Bevel fire-rated doors 1/8 inch in 2 inches on lock edge; trim stiles and rails only to extent permitted by labeling agency.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.3 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 14 16

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SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work performed under this Section includes the performance criteria, materials, production, and erection of access doors and frames for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all access door work as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to the following:

1. Access doors and frames for walls and ceilings.
2. Floor access doors and frames.

B. Related Requirements:
1. Division 22 “Plumbing” for plumbing devices that require access.
2. Division 23 “Mechanical” for HVAC devices that require access.
3. Division 26 “Electrical” for Electrical devices that require access.
4. Division 28 “Electronic Safety and Security” for safety and security devices that require access.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, substrates 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. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

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 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide access panels as fabricated by FF Systems Access Panels, Inc. or comparable product by one of the following:

1. Access Panel Solutions.
2. Acudor Products, Inc.
3. Babcock-Davis.
4. J. L. Industries, Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
5. Larsen's Manufacturing Company.
6. Metropolitan Door Industries Corp.
7. Milcor Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Aluminum Access Doors with Drywall Inserts **(at all public, occupied spaces)**

1. Basis-of-Design Product: FF Systems Access Panels, Inc., System F2AKL.
2. Assembly Description: Welded aluminum frame with both outer and inner frame of high grade aluminum, with drywall inlay.
3. Locations: Wall and ceiling.
4. Door Size: As indicated
5. Frame Material: Aluminum.
6. Hinges: Manufacturer's standard.
7. Seal: Air/dust seal.
8. Hardware: Cylinder-lock.

D. Hardware:

1. Lock: Cylinder.

2.3 FLOOR ACCESS DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide access panels as fabricated by Babcock Davis or comparable product by one of the following:

1. Acudor Products, Inc.
2. Metropolitan Door Industries Corp.
3. Milcor Inc.

B. Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.

C. Aluminum Floor Door: Coordinate with equipment. Extruded-aluminum angle frame with 1/4-inch-(6.4-mm-) thick, 1/8-inch pan recess for carpet or tile; nonwatertight; loading capacity to support 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load.

D. Hardware: Provide the following:

1. Hinges: Heavy-duty, stainless-steel butt hinges with stainless-steel pins.
2. Lock: Manufacturer’s standard.
3. Hardware Material: Manufacturer's standard.

E. Fire-Rating: Provide 2-hour fire rated doors in rated floors.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. 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.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

G. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

H. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

I. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness according to ANSI H35.2 (ANSI H35.2M).

J. Frame Anchors: Same type as door face.

K. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

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.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

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. 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, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

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.

3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

F. Aluminum Finishes:

1. Mill finish.

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. 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.

3.4 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 08 31 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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 performance criteria, materials, production, and erection of aluminum framed entrances and storefronts for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all aluminum framed entrances and storefronts as required by the this section, schedules, keynotes and drawings, including, but not limited to the following:

1. Exterior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

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.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

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

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Delegated-Design Submittal: For aluminum-framed entrances and storefronts 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. Preconstruction Laboratory Mockup Testing Submittals:

1. Testing Program: Developed specifically for Project.
2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data: For Installer and field testing agency.

C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

D. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

E. Quality-control program for structural-sealant-glazed system.

F. Preconstruction sealant testing.

1.8 MOCKUPS

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

1. Build mockup of typical wall area as shown on Drawings.
2. Mockups for each form of construction and finish.
3. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals**,** metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: 118 mph, and in compliance with NYS Building Code Section 2404 "Wind, Snow, Seismic, and Dead loads on Glass."
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans less than 11 feet 8-1/4 inches (3.6 m).

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

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

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

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2. Entrance Doors:

    a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
    b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

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

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

J. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

K. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.47 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 15 as determined according to NFRC 500.

L. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 26.

M. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 5.

1. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.

N. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

O. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.
2. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

P. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide systems that match size and appearance of aluminum windows within the specifications of this section division, Trifab 451T (thermal) Storefront System, as manufactured by Kawneer Company, Inc., or comparable product by one of the following:

1. Architectural Windows.
2. Efco Corporation.
3. CRL – U.S. Aluminum

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and venting windows and accessories, from single manufacturer.

2.3 FRAMING

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

1. Construction: Thermally broken.
2. System Dimensions: 2” x 4 ½” (50.8mm x 114.3 mm).
3. Glazing Plane: Front (exterior).
4. Finish: High-performance organic finish.
5. Color: Anodized Aluminum- Dark Bronze.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2-inch overall thickness, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium or Wide stile. 10” high bottom rail for ADA compliance.
3. Glazing stops and gaskets.
4. Material: extra thick (3/16”)

B. Entrance Door Hardware: Refer to Section 08 71 00 "Door Hardware.”

1. Weather stripping: manufacturer’s standard.
2. All hardware to be surface mounted to facilitate future maintenance.
3. Hardware finishes: As selected by Architect from Manufacture’s full range.

C. Additional requirements:

1. Thresholds: Stainless steel, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).
2. Opening-Force Requirements:
   a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion[and not more than 15 lbf (67 N) to open the door to its minimum required width].
   b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
3. Removable Mullions: BHMA A156.3, extruded aluminum. **On Exterior Doors Only.**
   a. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for

panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

2.5 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

E. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.

1. Color: As selected by Architect from manufacturer's full range of colors.

F. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads fabricated from 300 series stainless steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. 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.

E. Aluminum sunscreen extrusion profile – to be selected by Architect from Manufacturer's standard profiles. Anchored directly to the vertical or horizontal mullions – refer to Drawings. Color to match storefront and windows.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Coating 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 manufacturer's written instructions.

1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605

    a. Color and Gloss: Match Architect's sample of Alucobond Anodic Dark Bronze Anodized PVDF-2/gloss level-30.
    b. It is the intent that all aluminum framing members on the project shall match in color and gloss.

2.9 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
    c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts and mockups.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

    a. Perform a minimum of two tests in areas as directed by Architect.
    b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

1. Test a minimum of three areas on each building facade.
2. Repair installation areas damaged by testing.

D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. 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 entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

1.02 RELATED REQUIREMENTS

Section 07 92 00 - Joint Sealants

Section 08 51 13 - Aluminum Windows

1.03 DEFINITIONS

Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.04 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

E. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems; 2014.

F. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes..

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

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

H. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed curtain wall systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following.

1. Joinery.

2. Glazing.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed performance requirements.

C. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.

D. Source Limitations: Obtain aluminum curtain wall system through one source from a single manufacturer.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

1.08 MOCK-UP

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

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

C. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.

1. Warranty Period: Two (2) year from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads. Failure also includes the following.

a. Thermal stresses transferring to building structure.

b. Glass breakage.

c. Loosening or weakening of fasteners, attachments, and other components.

d. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind loads: Provide Curtain Wall system; include anchorage, capable of withstanding wind load design pressures shown on the structural drawing sheet S-002 for each building. The design pressures are based on 2015 International Existing Building Code.

D. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.2 psf (300 Pa).

E. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

F. Water Resistance, (dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

G. Uniform Load: A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

H. Seismic: When tested to AAMA 501.4, system must meet design displacement (elastic) of 0.010 x the story height and ultimate displacement (inelastic) of 1.5 x the design displacement.

I. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.66 (clear).

J. Condensation Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than 68frame and 54glass (clear).

K. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.43 (HP glass).

L. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 71frame and 71glass (HP glass).

M. Sound Transmission Loss: When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than:

1. STC 31 or OITC 26 based upon 1" (25.4) insulating glass (1/4", 1/2" AS, 1/4").

N. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E1886, information in ASTM E1996, and TAS 201/203.

1. Large – Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.

2. Small – Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.

2.02 MANUFACTURERS

A. Basis-of-Design: Kawneer Company Inc., 1620 Wall System™1 Curtain Wall – 2”, outside glazed pressure plate format..

1. System depth: 7 1/2" for 1" insulating glazing.

B. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below..

1. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.

2. Manko Window Systems, Inc: www.mankowindows.com/#sle.

3. EFCO, a Pella Company; www.efcocorp.com/#sle.

4. Pittco Architectural Metals Inc: www.pittcometals.com/#sle.

5. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.

6. Wausau Window and Wall Systems: www.wausauwindow.com/#sle.

7. YKK AP America Inc: www.ykkap.com/#sle.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. MATERIALS

1. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.78) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

2. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.

3. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

4. 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 or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

5. Reinforcing Members: Aluminum, 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 or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

6. Sealant: For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

7. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides a minimum 1/4" (6.3) separation.

8. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

E. Curtain Wall Framing

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

   a. Glazing System: 4 sided captured

   b. Glazing Plane: Front.

2. Glass: 1" insulating glass option.

3. Aluminum Finishes:

   a. Kawneer Anodized AAMA 611, Dark Bronze

4. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

5. Framing Sealants: Shall be suitable for glazed aluminum curtain wall as recommended by sealant manufacturer.

6. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.

F. Glazing

1. Comply with Division 08 Section “Glazing”. Following glazing options are available.

2. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.

3. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

4. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

5. Glazing Sealants: As recommended by manufacturer for joint type.

G. Operable Units

1. Windows:

a. Series 8400TL Thermal Window - Horizontal Sliding Window.

2.03 ACCESSORIES

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics.

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints.

3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

5. Provisions for field replacement of glazing from exterior.

6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

7. Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

C. Curtain Wall Framing: Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide manufacturer's field representative to inspect upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

C. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Contractor will engage a qualified testing agency to perform tests and inspections.

a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.

b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.07 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610, prior to owner's acceptance.

D. Remove construction debris from project site and legally dispose of debris.

3.08 PROTECTION

A. Protect installed product's finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

END OF SECTION 08 44 13

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SECTION 08 51 13 - ALUMINUM WINDOWS

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 performance criteria, materials, production, and erection of aluminum windows for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all aluminum windows as required by the this section, schedules, keynotes and drawings.

B. Related Requirements:

1. Division 08 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches (50 by 100 mm).
2. Exposed Hardware: Full-size units.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

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

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum 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, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 2 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide systems that match size and appearance of aluminum windows within this specification division, Trifab 451T (thermal) Storefront System, as manufactured by Kawneer Company Inc., or comparable product by one of the following:

1. Architectural Windows.
2. Efco Corporation.

B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: AW.
2. Minimum Performance Grade: 70.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K), maximum.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40 maximum.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

G. Sound Transmission Class (STC): Rated for not less than 26 STC, minimum, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

H. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC, minimum, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Horizontal Sliding- 8400 TL Series

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: ASTM E 2190.

1. Refer to Specifications Section 08 80 00 “Glazing.”

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal and as indicated in Glazing Section.

E. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less.

F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

A. Integral Ventilating System/Device: Where indicated, provide weather-stripped, adjustable, horizontal fresh-air vent, with a free airflow slot, full width of window sash when open, complying with AAMA/WDMA/CSA 101/I.S.2/A440. Equip vent bar with an integral insect screen, removable for cleaning.

1. Limit stops – restrict window opening to a maximum of 8". Install with vandal-resistant screws.

B. Jamb/Head/Sill Extender – to set back aluminum windows from face of opening by 6" – finish and color to match window frame. Refer to Drawings.

C. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

F. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.

1. Wire-Fabric Finish: Natural bright.

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: 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.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Coating 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 manufacturer's written instructions.

1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

    a. Color and Gloss: Match Architect’s sample of Alucobond Anodic Dark Bronze Anodized PVDF-2/gloss level-30.
    b. It is the intent that all aluminum framing members on the project shall match in color and gloss.

2. Aluminum windows, aluminum storefront walls and entry storefronts shall have same finish.

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 the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
b. Allowable Air-Leakage Rate: 1.5 imes the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

   a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
   b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

   1. Keep protective films and coverings in place until final cleaning.

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. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 08 51 13

SECTION 08 56 67 - BULLET-RESISTANT STEEL TRANSACTION WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bullet-resistant fixed steel transaction window assemblies.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. American Welding Society (AWS) D1.3/D1.3M - Structural Welding Code - Sheet Steel.

B. ASTM International (ASTM) A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

C. Underwriters Laboratories (UL) 752 - Bullet Resisting Equipment.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Provide window frames of “non-ricochet type" intended to permit capture and retention of attacking projectile, lessening potential of random injury or lateral penetration.

1.4 SUBMITTALS

A. Submittals for Review:
   1. Shop Drawings: Include window profiles and sizes, type and spacing of frame anchors, reinforcement size and locations, details of joints and connections, and welding details.
   2. Product Data: Include product description for window assemblies including bullet-resistant ratings.
   3. Samples: 2 x 2 inch coating samples showing available colors.

B. Closeout Submittals:
   1. Maintenance Data: Include instructions for cleaning of glazed panels.

1.5 QUALITY ASSURANCE

A. Transaction Window Assemblies: Ballistic Level 3, tested to UL 752.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store window assemblies upright in protected, dry area, off ground or floor, with at least 1/4 inch space between individual units.

B. Do not cover with non-vented coverings that create excessive humidity.

C. Remove wet coverings immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by ARMORTEX, 5926 Corridor Parkway, Schertz, Texas, 800-880-8306, www.armortex.com.

Basis of Design: Transaction Window NV Split Frame, Model: W1-TW-NV-SA by ARMORTEX.

B. Covenant Security Equipment
C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Steel Sheet:
   1. ASTM A1008/1008M, cold rolled, free from scale, pitting, coil breaks, and other surface defects.
B. Bullet-Resistant Composite: UL Listed Bullet Resistant Composite by ARMORTEX, of UL Ballistic Level equal to specified frame ballistic protection level.

C. Glazing:
   1. UL Listed laminated glass or glass/polycarbonate composite.
   2. Bottom edge of glazing panel provided with 18 gage stainless steel cap.

D. Track and Hangers:
   1. Stainless steel 12 gage track guard and guide.

2.3 FABRICATION

A. Frames:
   1. Fabricate from 16 gage steel lined with bullet-resistant composite.
   2. Bullet-resistant rating equivalent to or greater than glazing.
   3. Weld frame corners; knock-down and mechanical joints not acceptable.
   4. Frame modules capable of being joined with other frame modules to form continuous line.
   5. Replacement of glazing from secure side of window, not requiring removal of frame from opening.

B. Shelf: Minimum 2 inches thick with recessed dip tray, full width of window x minimum 12 inches deep, centered under glazing, covered with 18 gage stainless steel.

C. Dip Tray: Model RMDT1016, 16 gage stainless steel, 10 x 16 inches to outside edge of flanges, clear 1-5/8 inch open depth under glazing.

D. Welding: In accordance with AWS D1.3/D1.3M. Grind exposed welds flush and smooth.

E. Finish work neat and free from defects.

F. Allowable Tolerances: Plus or minus 1/16 inch for frame opening width, height, diagonal dimensions, and overall width and height (outside to outside).

2.4 FINISHES

A. Stainless Steel: No. 3 brushed finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install window assemblies in accordance with manufacturer's instructions and approved Shop Drawings.

B. Set plumb and level.

C. Secure to adjacent construction using fastener type best suited to application.

D. Field alterations to window assemblies not permitted unless approved in advance by manufacturer and Architect.

3.2 ADJUSTING

A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION 08 56 67

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SECTION 08 71 00 – DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware”.
2. Division 08 Section “Automatic Door Operators”.
3. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. 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.

1.6 MAINTENANCE SERVICE

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 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.
2. Section 08 71 13 – Automatic Door Operators.
3. Section 28 13 00 – Access Control.
4. Section 28 15 00 – Access Control Hardware Devices.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. RU - Corbin Russwin
6. HS - HES
7. RF - Rixson
8. NO - Norton
9. OT - Other

Hardware Sets

Set: 1.0

Doors: E-105, E-112, E-112W

1	Continuous Hinge	FM__SLF-HD1		PE	087100
1	Rim Exit Device	PED5257 M52 N957PT	630	RU	087100
2	Cylinder	As Required	626	RU	087100
1	Surface Closer	DC8210 A11	689	RU	087100
1	Threshold	to architect detail		PE	087100

Set: 2.0

Doors: E-120

1	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
1	Electric Power Transfer	EL-CEPT	630	SU	087100

1	Rim Exit Device	PED5255 MELR N955PT	630	RU	087100	⚡
1	Cylinder	As Required	626	RU	087100	
1	Automatic Opener & Paddles	By Others		SM	087113	⚡
1	Sweep	345AV		PE	087100	
1	Threshold	253x3AFG MSES10SS-2		PE	087100	

Set: 3.0

Doors: RG-200

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100	
1	Mullion	CR972BKM		RU	087100	
1	Electrified Rim Exit	PED52905 M52 N9905PT WM92	630	RU	087100	⚡
1	Rim Exit Device, Exit Only	PED5201 M52 EO WM92	630	RU	087100	
4	Cylinder	As Required	626	RU	087100	
1	Mulllion Cylinder Kit	As Required	626	RU	087100	
2	Conc Overhead Stop	1-X36	630	RF	087100	
2	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100	
1	Mullion Gasketing	5110BL		PE	087100	
2	Sweep	345AV		PE	087100	
1	Threshold	253x3AFG MSES10SS-2		PE	087100	
1	Wiring Diagram	Point to Point			087100	
2	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Card Reader	by Security System Supplier		OT	281300	
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 4.0

Doors: RG-201

1	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100	
1	Electrified Rim Exit	PED52905 M52 N9905PT WM92	630	RU	087100	⚡
2	Cylinder	As Required	626	RU	087100	
1	Conc Overhead Stop	1-X36	630	RF	087100	
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100	
1	Sweep	345AV		PE	087100	

1	Threshold	253x3AFG MSES10SS-2		PE	087100
1	Wiring Diagram	Point to Point			087100
1	Position Switch	DPS-M/W-BK		SU	087100
1	Card Reader	by Security System Supplier		OT	281300
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 5.0

Doors: E-136A, E-136B

2	Continuous Hinge	FM__SLF-HD1		PE	087100
1	Mullion	CR972BKM		RU	087100
2	Rim Exit Device, Exit Only	PED5201 M52 EO	630	RU	087100
3	Cylinder	As Required	626	RU	087100
1	Mulllion Cylinder Kit	As Required	626	RU	087100
2	Surface Closer	DC8210 A11	689	RU	087100
2	Sweep	345AV		PE	087100
1	Threshold	253x3AFG MSES10SS-2		PE	087100

Set: 5.1

Doors: E-136C

1	Continuous Hinge	FM__SLF-HD1		PE	087100
1	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
1	Electric Power Transfer	EL-CEPT	630	SU	087100
1	Mullion	CR972BKM		RU	087100
1	Rim Exit Device, Exit Only	PED5201 M52 EO	630	RU	087100
1	Rim Exit Device, Exit Only	PED5201 MELR M52 EO	630	RU	087100
2	Cylinder	As Required	626	RU	087100
1	Mullion Cylinder Kit	As Required	626	RU	087100
1	Surface Closer	DC8210 A11	689	RU	087100
1	Automatic Opener & Paddles	By Others		SM	087113
2	Sweep	345AV		PE	087100
1	Threshold	253x3AFG MSES10SS-2		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Set: 6.0

Doors: E-112E

1	Continuous Hinge	FM__SLF-HD1		PE	087100	
1	Rim Exit Device	PED5257 N957PT M92	630	RU	087100	⚡
2	Cylinder	As Required	626	RU	087100	
1	Surface Closer	DC8210 A11	689	RU	087100	
2	Sweep	345AV		PE	087100	
1	Threshold	253x3AFG MSES10SS-2		PE	087100	

Set: 9.0

Doors: 105, 112, 118-1 , 118-2

4	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
2	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Fire Rated Surf Vert Rod	ED5470BN-SN200 N9S605ET M55	630	RU	281500	⚡
1	Surface Vert Rod Exit, Exit Only	PED5401 A EO M92 M55	630	RU	087100	⚡
1	Cylinder	As Required	626	RU	087100	
2	Surface Closer	DC8210 A4	689	RU	087100	
1	Astragal	S771x6BL		PE	087100	
1	Gasketing	S442BL		PE	087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
2	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 9.1

Doors: 136

4	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
2	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Surface Vert Rod Exit, Exit Only	PED5401 A EO M92 M55	630	RU	087100	⚡

1	Surface Vert Rod Exit	PED5459 A MELR N9M59PT M92 M55	630	RU	087100	⚡
1	Cylinder	As Required	626	RU	087100	
1	Surface Closer	DC8210 A4	689	RU	087100	
1	Automatic Opener	6341	689	NO	087100	⚡
1	Astragal	S771x6BL		PE	087100	
1	Gasketing	S442BL		PE	087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wiring Diagram	Point to Point			087100	
2	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Card Reader	by Security System Supplier		OT	281300	
1	Wall Switch	700		NO	087100	⚡
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches, activates outside operator paddle & allows for authorized entrance. Operating inside touchpad or inside operator paddle activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 12.0

Not used

Set: 13.0

Doors: 120B

6	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
2	Fire Rated Multi-Point Lock	MP9800AxE10xN10 N M55 MPWD	626	RU	087100
2	Surf Overhead Stop	9-X36	630	RF	087100
2	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Astragal	S771x6BL		PE	087100
1	Gasketing	S442BL		PE	087100

Set: 14.0

Doors: T-122, T-123

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡

1	Storeroom Lock	ML2057 NSA M92 MELR	626	RU	087100	⚡
1	Automatic Opener	6341	689	NO	087100	⚡
1	Door Stop	RM850 / RM860	US26D	RO	087100	
3	Silencer	608		RO	087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wiring Diagram	Point to Point			087100	
1	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Card Reader	by Security System Supplier		OT	281300	
1	Wall Switch	700		NO	087100	⚡
1	Restroom Kit	575		NO	087100	
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: - Presenting valid credential outside activates operator paddle, shunts door contact & allows authorized entrance.
- Pushing inside restroom kit switch locks outside trim, deactivates operator paddles, locks outside trim & activated outside occupancy indicator.
- Operator paddles and card reader reactivated by either pushing inside restroom kit switch a second time or operating inside lever.

Set: 15.0

Doors: T-219, T-228

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Storeroom Lock	ML2057 NSA M92 MELR	626	RU	087100	⚡
1	Automatic Opener	6341	689	NO	087100	⚡
1	Door Stop	RM850 / RM860	US26D	RO	087100	
1	Gasketing	S442BL		PE	087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wiring Diagram	Point to Point			087100	
1	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Card Reader	by Security System Supplier		OT	281300	
1	Wall Switch	700		NO	087100	⚡
1	Restroom Kit	575		NO	087100	
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: - Presenting valid credential outside activates operator paddle, shunts door contact & allows authorized entrance.
- Pushing inside restroom kit switch locks outside trim, deactivates operator paddles, locks outside trim & activated outside occupancy indicator.
- Operator paddles and card reader reactivated by either pushing inside restroom kit switch a second time or operating inside lever.

Set: 16.0

Doors: 218, 220, 220A

5	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Dust Proof Strike	570	US26D	RO	087100	
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100	
1	Access Control Cyl Lock	CLX33605-SN200 NZD	626	RU	281500	⚡
1	Coordinator	2600 Series x Mtg. Brkts. & Wear Plates as Required	Black	RO	087100	
2	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100	
2	Door Stop	RM850 / RM860	US26D	RO	087100	
1	Astragal	S771x6BL		PE	087100	
1	Gasketing	S442BL		PE	087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wiring Diagram	Point to Point			087100	
1	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 17.0

Doors: M-119

5	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Dust Proof Strike	570	US26D	RO	087100	
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100	
1	Access Control Cyl Lock	CLX33605-SN200 NZD	626	RU	281500	⚡
1	Coordinator	2600 Series x Mtg. Brkts. & Wear Plates as Required	Black	RO	087100	
2	Surface Closer	DC8210 A4	689	RU	087100	
1	Astragal	S771x6BL		PE	087100	
1	Gasketing	S442BL		PE	087100	

1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wiring Diagram	Point to Point			087100	
1	Position Switch	DPS-M/W-BK		SU	087100	⚡
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 18.0

Doors: 100S, 101A, 124, 125, 126A, 128

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Access Control Cyl Lock	CLX33605-SN200 NZD	626	RU	281500	⚡
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100	
1	Door Stop	RM850 / RM860	US26D	RO	087100	
3	Silencer	608		RO	087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wiring Diagram	Point to Point			087100	
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100	⚡

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 19.0

Doors: 112A, 230A

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Access Control Cyl Lock	CLX33605-SN200 NZD	626	RU	281500	⚡
1	Conc Overhead Stop	1-X36	630	RF	087100	
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100	
3	Silencer	608		RO	087100	

1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Wiring Diagram	Point to Point			087100
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 20.0

Doors: 102, 103, 107, 110, 202, 206, 209, 210, 212, 213, 217, 218A, 221, 222, 223, 224, 225, 226, 227

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100
1	Access Control Cyl Lock	CLX33605-SN200 NZD	626	RU	281500
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Door Stop	RM850 / RM860	US26D	RO	087100
1	Gasketing	S442BL		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Wiring Diagram	Point to Point			087100
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 21.0

Doors: 111, 127, 201, 203, 204, 205, 207, 208, 211, C-121

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100
1	Access Control Cyl Lock	CLX33605-SN200 NZD	626	RU	281500
1	Surf Overhead Stop	9-X36	630	RF	087100
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Gasketing	S442BL		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100

1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Wiring Diagram	Point to Point			087100
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 22.0

Doors: 118H

6	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100
1	Storeroom Lock	CLX3357 NZD	626	RU	087100
1	Coordinator	2600 Series x Mtg. Brkts. & Wear Plates as Required	Black	RO	087100
2	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
2	Door Stop	RM850 / RM860	US26D	RO	087100
2	Silencer	608		RO	087100

Set: 23.0

Doors: 120A

6	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
2	Flush Bolts	555	US26D	RO	087100
1	Storeroom Lock	CLX3357 NZD	626	RU	087100
1	Surface Closer	DC8210 A4	689	RU	087100
2	Silencer	608		RO	087100

Set: 24.0

Doors: 112B, 118A

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Storeroom Lock	CLX3357 NZD	626	RU	087100
1	Concealed Overhead Stop	2-X36	630	RF	087100
3	Silencer	608		RO	087100

Set: 25.0

Doors: 118F. 118G, 119A, 216A, J-214, M-119-1

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Storeroom Lock	CLX3357 NZD	626	RU	087100
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Door Stop	RM850 / RM860	US26D	RO	087100
1	Gasketing	S442BL		PE	087100

Set: 26.0

Doors: 105A

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Storeroom Lock	CLX3357 NZD	626	RU	087100
1	Surf Overhead Stop	10-X36	630	RF	087100
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Gasketing	S442BL		PE	087100

Set: 27.0

Doors: 119B

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Entrance Lock	CLX3351 NZD	626	RU	087100
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Door Stop	RM850 / RM860	US26D	RO	087100
1	Gasketing	S442BL		PE	087100

Set: 28.0

Doors: 136A

6	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Flush Bolt	555	US26D	RO	087100
1	Conc Overhead Stop	1-X36	630	RF	087100
2	Surf Overhead Stop	9-X36	630	RF	087100
2	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Astragal	S771x6BL		PE	087100
1	Gasketing	S442BL		PE	087100

Set: 29.0

Doors: T-229

2	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Fail Safe Lock	ML20906-SAF NSA M92	626	RU	087100	⚡
1	Electric Strike	1600-CLB	BSP	HS	087100	⚡
1	Automatic Opener	6341	689	NO	087100	⚡
1	Door Stop	RM850 / RM860	US26D	RO	087100	
3	Silencer	608		RO	087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
2	Wall Switch	700		NO	087100	⚡
1	Restroom Kit	575		NO	087100	

Notes: - Operator paddles open door.
- Pushing inside restroom kit switch locks outside trim, deactivates operator paddles, & activated outside occupancy indicator.
- Door unlocked & operator paddles reactivated by pushing inside restroom kit switch a second time or operating inside lever.

Set: 30.0

Doors: C-110A, C-110B

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Passage Latch	CLX3310 NZD	626	RU	087100
1	Conc Overhead Stop	1-X36	630	RF	087100
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
3	Silencer	608		RO	087100

Set: 31.0

Doors: C-113A, C-113B

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Passage Latch	CLX3310 NZD	626	RU	087100
1	Surf Overhead Stop	9-X36	630	RF	087100
1	Surface Closer	DC8200 / DC8210 (Arm as Required)	689	RU	087100
1	Gasketing	S442BL		PE	087100

Set: 32.0

Doors: L-108, L-109, T-104, T-106, T-116, T-117, T-215, T-216

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100

3	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	US26D	MK	087100	⚡
1	Passage Latch	ML2010 NSA MELR	626	RU	087100	
1	Automatic Opener	6311	689	NO	087100	⚡
1	Door Stop	RM850 / RM860	US26D	RO	087100	
1	Gasketing	S442BL		PE	087100	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡
1	Wall Switch	700		NO	087100	⚡

Set: 33.0

Doors: L-116, L-117, T-134, T-135

3	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Push Pull	BF 111x73C/73CL	US32D	RO	087100	
1	Automatic Opener	6311	689	NO	087100	⚡
1	Door Stop	RM850 / RM860	US26D	RO	087100	
3	Silencer	608		RO	087100	
1	Wall Switch	700		NO	087100	⚡

Set: 34.0

Doors: 114, C-202

3	Hinge	By door manufacturer				
1	Exit Device	By door manufacturer x Matching Lever				
1	Door Stop	RM850 / RM860	US26D	RO	087100	
1	Set Smoke Seals	By door manufacturer				

Set: 35.0

Doors: 101, 126, 230, C-140. C-201, E-ST-1,

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100	
2	Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
2	Concealed Vert Rod Exit	PED4850T MELR P12 M92	630	RU	087100	⚡
1	Auxiliary Control	PED155	626	RU	087100	
2	Surface Closer	DC8210 A11	689	RU	087100	
1	Automatic Opener & Paddles	By Others		SM	087113	⚡
1	Threshold	253x3AFG MSES10SS-2		PE	087100	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100	⚡

1	Wiring Diagram	Point to Point			087100
2	Position Switch	DPS-M/W-BK		SU	087100
1	Card Reader	by Security System Supplier		OT	281300
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes: Door closed & locked at all times. Presenting valid credential outside shunts door position switches, activates outside operator paddle & allows for authorized entrance. Operating inside touchpad or inside operator paddle activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 36.0

Doors: 113

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
2	Electric Power Transfer	EL-CEPT	630	SU	087100
2	Concealed Vert Rod Exit	PED4850T MELR P12 M92	630	RU	087100
1	Auxiliary Control	PED155	626	RU	087100
2	Surface Closer	DC8210 A11	689	RU	087100
1	Threshold	253x3AFG MSES10SS-2		PE	087100
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Wiring Diagram	Point to Point			087100
2	Position Switch	DPS-M/W-BK		SU	087100
1	Card Reader	by Security System Supplier		OT	281300
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes:

Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 37.0

Doors: E-100W

1	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100

1	Electric Power Transfer	EL-CEPT	630	SU	087100
1	Rim Exit Device, Night latch	PED4257T MELR P12 K157 M92	630	RU	087100
1	Surface Closer	DC8210 A11	689	RU	087100
1	Threshold	253x3AFG MSES10SS-2		PE	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Wiring Diagram	Point to Point			087100
1	Position Switch	DPS-M/W-BK		SU	087100
1	Card Reader	by Security System Supplier		OT	281300
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Notes:

Door closed & locked at all times. Presenting valid credential outside shunts door position switches & allows for authorized entrance. Operating inside trim activates request to exit switch shunting door contact and allowing authorized egress at all times. With loss of power door remains locked.

Set: 38.0

Doors: 100W

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
1	Grade 1 Cylindrical Lever	NDSOTDEU x RHO x 13-247 x 10-025x1CXx 50-231	643e	RU	312A
1	Closer	4040XP.SCUSHL695 {L}	695	RU	501A
1	Position Switch	DPS-M/W-BK		SU	087100
1	Push Button Release	660-PB		RU	805A
2	Surface Closer	DC8210 A11	689	RU	087100
1	Threshold	253x3AFG MSES10SS-2		PE	087100
2	ElectroLynx Harness - Frame	QC-C1500P		MK	087100
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100
1	Wiring Diagram	Point to Point			087100
1	Card Reader	by Security System Supplier		OT	281300
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100

Set: 39.0

Doors: ST-1-1, ST-1-2

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
1	Rim Exit Device, Night latch	PED4257T MELR P12 K157 M92	630	RU	087100
1	Surface Closer	DC8210 A11	689	RU	087100
1	Kick plate	8400 10" X 1" LDW B4E	630	RU	
1	Door Stop	RM850 / RM860	US26D	RO	087100
1	Astragal	S771x6BL		PE	087100
1	Gasketing	S442BL		PE	087100

Set: 40.0

Doors: 100C, 100D

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
2	Dummy Push Bar	330	626	IVE	
2	90 DEG OFFSET PULL	8190HD 10" STD	630	IVE	
2	OH STOP	100S	630	RU	
2	Surface Closer	DC8210 A11	689	RU	087100
2	Blade Stop Spacer	4110		RU	
2	Mounting Plate	4110-18	689	RU	

Set: 41.0

Doors: E-110A, E-100B

2	Continuous Hinge	FM__SLF-HD1		PE	087100
1	Electric Power Transfer	EL-CEPT	630	SU	087100
2	Rim Exit Device, Exit Only	PED5201 M52 EO	630	RU	087100
2	Cylinder	As Required	626	RU	087100
1	Mortise Cylinder	26-091-ICX	626	RU	
1	Primus Core	20-740-XP	626	RU	
2	90 DEG OFFSET PULL	8190hd 10" std	630	RU	
2	Oh stop	100s	630	RU	
2	Surface Closer	DC8210 A4	689	RU	087100
2	Mounting Plate	4110-18	689	RU	
2	Blade Stop Spacer	4110		RU	
1	Mullion Gasketing	5110BL		PE	087100
2	Sweep	345AV		PE	087100
1	Threshold	253x3AFG MSES10SS-2		PE	087100
1	Power Supply	AQL Series (Amps & Relays as Required)		SU	087100
1	ElectroLynx Harness - Frame	QC-C1500P		MK	087100

1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)		MK	087100

Set: 42.0

Doors: 120

2	Continuous Hinge	FM__SLF-HD1 x PT		PE	087100
2	Concealed Vert Rod Exit	PED4850T MELR P12 M92	630	RU	087100
2	Cylinder	As Required	626	RU	087100
2	Mortise cylinder	26-091-icx	626	RU	
2	FSIC core	23-030	626	RU	
2	Surface Closer	DC8210 A4	689	RU	087100
3	Silencer	608		RO	087100

Set: 43.0

Doors: 222A

2	Continuous Hinge	FM__SLF-HD1 x PT	PE	087100
2	Silencer	608	RO	087100

Set: 50.0

Doors: 100A. C-200

SEE 08 11 16 – 2.07.B FOR OPERATING HARDWARE FOR FIRE-RATED ALUMINUM FULL VISION SINGLE DOORS.

END OF SECTION 08 06 71

SECTION 08 73 40 – OVERHEAD ROLLING DOOR AND GRILLE OPERATOR

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified shall be in accordance with the contract documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to furnish all the overhead Rolling Door and Grille Openers as shown on the drawings and specified herein.

1.3 RELATED SECTIONS

A. Section 055000 - Metal Fabrications

B. Section 087100 - Door Hardware

C. Section 099100 – Painting

D. Division 26 – Electrical

1.4 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

C. NEMA MG 1 - Motors and Generators.

1.5 DESIGN / PERFORMANCE REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

B. Electric Motors shall be alternating-current squirrel-cage motors conforming with NEMA MG 1.

C. Wiring Connections: Requirements for electrical characteristics.
   1. 115 volts, 60 Hz single phase.
   2. 208 volts, 60 Hz single phase or three phase.
   3. 230 volts, 60 Hz single phase or three phase.
   4. 460 volts, 60 Hz three phase.
   5. 575 volts, 60 Hz three phase.

1.6 SUBMITTALS

A. Submittals: shall be in accordance with Conditions of the Contract, Division 1, and General Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Details of construction and fabrication.
   4. Installation methods.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, required clearances and accessories. Include relationship with adjacent construction.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified with minimum of five years documented experience.

B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Install in areas designated by Architect.
   2. Do not proceed with remaining work until workmanship and installation is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Provide operators with a 2 year or 20,000 cycle limited warranty on motor and parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
   1. Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. Phone: (469) 549-7100. **(Basis of Design)**
   2. Cloplay Door, 8585 Duke Boulevard, Mason, OH 45040. Phone: 1-800-225-6729.
   3. Cookson Company, 2417 S. 50 Ave., Phoenix, AZ 85043 Phone: 1-800-294-4358

B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 OVERHEAD ROLLING DOOR AND GRILLE OPERATORS

A. Commercial Rolling Door and Grille Operator: Model RSX Commercial Standard Duty Door Operator:
   1. Application:
      a. Rolling Steel Doors.
      b. Rolling Steel Fire Doors.
      c. Rolling Steel Grilles.
   2. Electric Motor: UL listed.
      a. Rating:
         1) 1/2 horsepower single phase or three.
         2) 3/4 single phase or three phase.
         3) 1 horsepower single phase or three phase.
      b. Motor frame comply with:
         1) NEMA 48 for 1/2 hp single phase.
         2) NEMA 56 for 1/2 hp three phase.
         3) NEMA 56 3/4 and 1 hp all phases.
      c. Construction:
         1) Open drip-proof construction.
         2) Totally Enclosed Non Ventilated – TENV construction.
         3) Totally Enclosed Fan Cooled – TEFC construction.
         4) Washdown – NEMA 4 / NEMA 4X construction
      d. Reduction: Primary reduction is SuperBelt, an auto tension poly-V flex belt that does not require adjustment. Secondary reduction is by chain and sprocket.
      e. Duty cycle: Accommodate standard usage, up to 60 cycles per hour during peak usage periods.
         1) Brake: DC Disc type with selectable Progressive Braking for smooth stopping.
         2) Clutch: Adjustable friction disc type.
         3) Limit System: LimitLock limit system, magnetic type providing absolute positioning with push to set and remote setting capabilities. Limit System shall remain synchronized with the door during manual operation and supply power interruptions.
   3. Control System: Microprocessor based with relay motor controls on a single board. System incorporates a 16 character Liquid Crystal Display (LCD) to display the system status. System shall include the following:
      a. Capable of monitoring and reporting on a variety of operating conditions, including: Current operating status, Current command status, Motor movement status, Current error status (if applicable),

Hoist Interlock status (if applicable), External Interlock status, and 24VDC status.

b. A delay-on-reverse operating protocol.
c. Maximum run timers in both directions of travel that limit motor run time in the event a clutch slips or some other problem occurs.
d. Provisions for connection of a 2-wire monitored photo-eye or a 2-wire monitored edge sensor, as well as non-monitored standard 2-wire sensing edges, photo-eyes or other entrapment protection devices.
e. Control action will be constant contact close until a monitored entrapment device is installed, allowing for selection of momentary contact.
f. Provisions for connection of single and/or 3-button control stations.
g. Provisions for connection of an external 3-wire radio controls and related control devices.
h. On board open, close and stop control keys for local operation.
i. CodeDodger radio receiver that is dual frequency cycling at 315 Mhz and 390 Mhz capable of storing 250 single button and/or 250 Open-Close-Stop transmitters with the ability to add and/or delete transmitters individually, identify and store activating transmitter IDs.

4. Mounting:
   a. Rolling Steel doors:
      1) Front of hood and chain/sprocket coupling to door.
      2) Top of hood and chain/sprocket coupling to door.
      3) Wall-mount and chain/sprocket coupling to door.
      4) Bench mount and chain/sprocket coupling to door.
      5) Front of hood horizontal and chain/sprocket coupling to door.
      6) Mounting for Hoist models, Left Hand or Right Hand.
5. Release:
   a. Release shall be a pull and hold type mechanism with single cable operation and an integrated interlock switch.
6. Hoist: Chain hoist consists of chain pocket wheel, chain guard and smooth hand chain on hoist units.
7. Entrapment Protection:
   a. Control system shall have provisions to connect monitored entrapment protection devices such as monitored electric sensing edge or monitored photo-eye and to provide constant contact close control operation in lieu of such devices.
8. Control accessories:
   a. Operator Controls:
      1) Push-button operated control stations with open, close, and stop buttons.
      2) Key operation with open, close, and stop controls.
      3) Push-button and key operated control stations with open, close, and stop buttons.
      4) Controls for interior location.
      5) Controls for exterior location.
      6) Controls for both interior and exterior location.
      7) Controls surface mounted.
      8) Controls flush mounted.
   b. Special Operation:
      1) Vehicle detector operation.
      2) Radio control operation.
      3) Card reader control.
      4) OHD monitored photo-eyes.
      5) Commercial photo-eyes.

6) Timer Close Module for unattended timed door closing. Auxiliary control inputs, safety inputs, timer hold input and automatic door closing feature with selectable time delay. Safety inputs can be configured using on board keypad.
7) Commercial light package.
8) Auxiliary Output Module for up, down, and mid-stop limit status via several auxiliary sets of dry contacts that are microprocessor controlled. ADA compliant outputs that activate when door is moving up, down, or both directions and can be configured using the on board keypad.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify door sizes, configuration, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly without distortion or stress.

C. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

D. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean components using non-abrasive materials and methods recommended by manufacturer.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.7 SCHEDULES

A. Provide an operator at:
   1. all rolling doors at the servery room number 06-S107-9

3.8 WASTE MANAGEMENT

A. Coordinate with Section 01 74 19.

   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 08 73 40

SECTION 08 80 00 – GLAZING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows
   2. Vision Lites / Interior Borrowed Lites
   3. Entrances and other doors
   4. Door lites

B. Related Sections: The following sections contain requirements that relate to this Section.
   1. Division 06 Section "Rough Carpentry”
   2. Division 07 Section “Joint Sealants”
   3. Division 08 Sections "Aluminum Entrances & Storefronts", "Flush Wood Doors", “Translucent Insulated Glazing Panels” and “Glazed Aluminum Curtain Wall”
   4.

C. This work includes all exterior glazing at windows, storefronts and curtainwalls.

1.3 DEFINITIONS

A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (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; and other defects in construction.

B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
   1. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
      a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
   1. Temperature Change (Range): 120 F deg, ambient; 180 F deg, material surfaces.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each glass product and glazing material indicated.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Samples for verification purposes of 12-inch square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.

E. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
   1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

F. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

G. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

H. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

I. Maintenance data for glass and other glazing materials to include in Operating and Maintenance Manual specified in Division 1.

1.6 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. FGMA Publications: "FGMA Glazing Manual."
   2. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines."

B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
   1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. Fire-Resistive Glazing Products for Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing to NFPA 257.

D. Fire-Resistive Glazing Products for Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing to NFPA 257.

E. Safety Glazing Products: Comply with testing requirements in 16CFR 1201
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft (0.84 sq. m) or less in exposed surface area on one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

F. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
   1. Insulating Glass Certification Council (IGCC).
   2. Associated Laboratories, Inc. (ALI).

3. National Certified Testing Laboratories (NCTL).

G. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

H. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:

1. Primary glass of each (ASTM C 1036) type and class indicated.
2. Heat-treated glass of each (ASTM C 1048) condition indicated.
3. Insulating glass of each construction indicated.
4. Fire resistive glass (ASTM E119) of each type and class indicated.

I. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. General: Warranties specified in this Article 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.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS

A. NOTE: ALL GLASS USED SHALL BE SAFETY GLASS MEETING REQUIREMENTS FOR CPSC 16 CFR 1201.

B. Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select). Minimum ¼ inch thick.
1. Class 1 (clear) unless otherwise indicated.

C. Heat-Treated Float Glass: ASTM C 1048, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below. Minimum ¼ inch thick.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated

D. 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.

E. Laminated Glass: ASTM C 1172 and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Interlayer: Polyvinyl butyral of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation
   a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat and pressure.
2. Laminating process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

F. Insulating-Glass Units, General: Factory-assembled 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 Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal, with primary and secondary sealants as follows:
4. Manufacturer’s standard sealants.
   a. Polyisobutylene and polysulfide.
   b. Polyisobutylene and hot-melt butyl.
   c. Polyisobutylene and silicone.
   d. Polyisobutylene and polyurethane
5. Spacer Specifications: Manufacturer's standard spacer material and construction.
6. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   a. Spacer Material: Aluminum with clear anodic finish.
   b. Corner Construction: Manufacturer's standard corner construction.
7. Low “E” Glass: Provide nominal 1” insulated glass comprised of inner ¼” pane of clear glass with Low “E” coating, ½” air space, outer ¼” pane of clear glass
8. Winter U-value: .31
9. SHGC U-0.38
10. Sealed insulating glass units shall be in conformance to ASTM E 774-92; permanent IGCC certification label for CBA rating level.

2.2 FIRE-RATED GLAZING PRODUCTS

A. Laminated Ceramic Glazing Material: Proprietary Category 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 (8-mm) nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft. (19.5 kg/sq. m); 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. Approved products: FireLite Plus®, nominal 5/16” (8mm) thick laminated glazing, surface; premium grade or approved equal.
4. Provide glazing resistant to heat rate of rise transfer, compliant with ASTM E 119, where required

2.3 GLAZING SEALANTS

A. General:

1. Compatibility: Provide 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.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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; 790.
    b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
    c. May National Associates, Inc.; Bondaflex Sil 290.
    d. Pecora Corporation; 890.
    e. Sika Corporation, Construction Products Division; SikaSil-C990.
    f. Tremco Incorporated; Spectrem 1.

2. Applications: For weather seal.

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

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; 799.
    b. GE Advanced Materials - Silicones; UltraGlaze SSG4000
    c. May National Associates, Inc.; Bondaflex Sil 200 GPN or Bondaflex Sil 201 FC.
    d. Polymeric Systems, Inc.; PSI-631.
    e. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
    f. Tremco Incorporated; Proglaze SSG or Tremsil 600.

2. Applications: For structural seal.

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

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; 795.
    b. General Electric; Siliglaze-II 2800
    c. Tremco Incorporated; Spectrum 2

2. Applications: Fire and Safety Rated Glazing
3. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.4 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 by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800 for products indicated below:
   1. AAMA 806.1.

B. Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.

C. Available Products: Subject to compliance with requirements, glazing tape that may be incorporated in the Work include, but is not limited to, the following:
   1. Back-Bedding Mastic Glazing Tape Without Spacer Rod:
      a. Dyna-Seal, Pecora Corp.
      b. PTI 626 Architectural Sealant Tape, Protective Treatments, Inc.
      c. S-M 5710 H.P Poly-Glaze Tape Sealant, Schnee-Morehead, Inc.
      d. SST-800 Tape, Tremco, Inc.
   2. Expanded Cellular Glazing Tape:
      a. Norseal V-980 Closed-Cell Glazing Tape, Norton Company.

2.5 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. EPDM, ASTM C 864.
   2. Silicone, ASTM C 1115.
   3. Thermoplastic polyolefin rubber, ASTM C 1115.
   4. Any material indicated above.

C. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:
   1. EPDM.
   2. Silicone.
   3. Thermoplastic polyolefin rubber.
   4. Any material indicated above.

D. 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 companies.
   1. Lock-Strip Gaskets:
      a. Stanlock Div., Griffith Rubber Mills.
   2. Preformed Gaskets:
      a. Advanced Elastomer Systems, L.P.
      b. Schnee-Morehead, Inc.
      c. Tremco, Inc.

2.6 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 involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: 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: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

H. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

2.7 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 GLAZING SCHEDULE

A. Exterior
   1. Type G1 – Clear Insulated Laminated Safety Glazing (LVT 70)
   2. Type G2 – Insulated Spandrel Glazing Panel
   3. Type G3 – Translucent Insulated Laminated Safety Glazing
   4. Type G4 – Clear Insulated Laminated Tempered Safety Glass with Bullet Resistant Film

B. Interior

1. Type IG1 – Clear Laminated Safety Glazing
2. Type IG2 - Clear Fire Rated Safety Glazing
3. Type IG3 – Clear High Impact Sports Glazing
4. Type IG4 – Clear Laminated Safety Glazing with Bullet Resistant Film

3.2 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

C. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.4 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where 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 from edge damage during handling and installation as follows:
   1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
   2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, 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 elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, 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.

3.5 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 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 lite is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.6 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past face of glazing stops.

3.7 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.8 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.9 CLEANING AND PROTECTION

A. Protect exterior glass from breakage 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, alkali deposits, or stains, and 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 faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.10 WASTE MANAGEMENT

A. Coordinate with Section 01 74 19.
   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 08 80 00

SECTION 08 80 01- TRANSLUCENT INSULATED GLAZING PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the translucent insulated glazing panels as shown and specified. Work includes providing and installing:

1. Flat translucent insulated glazing panels

B. Related Sections:

1. 08 80 00 GLAZING

1.2 SUBMITTALS

A. Submit shop drawings. Includes material descriptions, and elevations and details where applicable.

B. Submit sample in same thickness and material indicated for the work and in size indicated below.
1. Sandwich panels: 7” x 12” units

C. Submit product reports from a qualified independent testing agency indicating each type and class of panel complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required (if applicable) are:
a) Flame Spread and Smoke Developed (UL 723) – Submit UL Card
b) Burn Extent (ASTM D 635)
c) Color Difference (ASTM D 2244)
d) Impact Strength (UL 972)
e) Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
f) Bond Shear Strength (ASTM D 1002)
g) Insulation U-Factor (NFRC 100)
h) NFRC Visible Light Transmittance (NFRC 202 or Estimated per ASTM 972)
i) Solar Heat Gain Coefficient (NFRC or Estimated**)**

1.3 CLOSEOUT SUBMITTALS

A. Provide field maintenance manual.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Panels shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of materials being satisfactorily used on at least six projects of similar size, scope, and location. At least three of the projects shall have been in successful use for ten years or longer.

B. Installer's Qualifications: Installation shall be performed by experienced glazing installers and shall be of the highest quality.

1.5 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete glazing panel.

1. Structural Loads. Provide panel capable of handling the following loads:

a. Positive Wind Load (PSF): Refer to Project loads
b. Negative Wind Load (PSF): Refer to Project loads

B. Lateral Deflection Limits:

1. Glazing panels shall be supported on all four sides. Center of panel deflection at design wind pressure shall be no more than 1".

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F (43 deg C), ambient; 150 deg F (66 deg C), material surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver panels in manufacturer's standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.7 WARRANTY

A. Provide manufacturer's written warranty agreeing to repair or replace panels which fail in material or workmanship within ten years from the date of delivery, pro-rata

after five years. Failure of material or workmanship shall include the following: abnormal color change, fiberbloom, and delamination of surface coating.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project subject to compliance with the performance requirements of this specification and submission of evidence thereof. Listing other manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com

2.2 PANEL COMPONENTS

A. Face Sheets:

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
   a. Thermoplastic (e.g., polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.
2. Exterior face sheets:
   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after **5** years outdoor South Florida weathering at 5° facing south as measured on a white sample, with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
   b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by handheld pencil and repel an Hi-impact minimum of **230 ft. lbs.** without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
   c. Erosion Protection: Integral, embedded-glass erosion barrier.
3. Appearance:
   a. Exterior face sheet: Smooth, .070" thick and White in color.
   b. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core:

1. Thermally Broken Composite I-beam grid core shall be of alloy and temper recommended by manufacturer with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 1/2".
2. I-beam Thermal break: Minimum 5/8" thermoset fiberglass composite. Poured and de-bridged thermal break is not acceptable.

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council “Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

a. 50% Relative Humidity at 68° F: 540 PSI
b. 182° F: 100 PSI
c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 1-3/4 inches
2. Grid Core Insulation: Fill panel cores with **fiberglass batt**
3. Panel U-factor by NFRC certified laboratory:

a. 1-3/4” thermally broken grid **0.28**

4. Visible Light Transmittance (VLT):

a. Visible LT (NFRC 202) by NFRC certified laboratory: 40% For White/White face sheet combinations only

PART 3 – EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure, and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install the panels in accordance with the manufacturer's fabrication drawings.

3.3 FIELD QUALITY CONTROL

A. Repair or replace work that does not pass quality control inspection.

3.4 CLEANING

A. Clean the panel, interior and exterior, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 08 80 01

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SECTION 08 83 00 - MIRRORS

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. The work performed under this Section includes the performance criteria, materials, production, and erection of Mirrors for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all Mirrors as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to the following:

1. Tempered glass mirrors qualifying as safety glazing.

B. Related Sections:

1. Division 08 "Glazing" for glass with reflective coatings used for vision and spandrel lites.

1.3 ACTION SUBMITTALS

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

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of the following products:

1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches (300 mm) long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of mirror and mirror mastic, from manufacturer.

C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing film and substrates on which mirrors are installed.

D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

D. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

E. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

F. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing film and substrates on which mirrors are installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

B. Mirror shall be installed flush with tile.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Refer to Restroom and Accessory Schedule for toilet room mirror bases of design.

B. Where mirror product is not specifically noted otherwise, furnish and install glass Mirrors, General: ASTM C 1503**;** manufactured using copper-free, low-lead mirror coating process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arch Aluminum & Glass Co., Inc.
b. Donisi Mirror Company.
c. Gardner Glass, Inc.
d. Guardian Industries.
e. Independent Mirror Industries, Inc.
f. Lenoir Mirror Company. National Glass Industries.
g. Stroupe Mirror Co., Inc.
h. Sunshine Mirror; Westshore Glass Corp.
i. Virginia Mirror Company, Inc.
j. Walker Glass Co., Ltd.

C. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Franklin International; Titebond Division.
b. Laurence, C. R. Co., Inc.
c. Macco Adhesives; Liquid Nails Division.
d. OSI Sealants, Inc.
e. Palmer Products Corporation.
f. Pecora Corporation.
g. Royal Adhesives & Sealants; Gunther Mirror Mastics Division.
h. Sommer & Maca Industries, Inc.

2. Adhesive shall have a VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.05 inch (1.3 mm).

a. Products: Subject to compliance with requirements, provide one of the following:

1) Laurence, C. R. Co., Inc.; CRL Standard "J" Channel.
2) Sommer & Maca Industries, Inc.; Aluminum Shallow Nose "J" Moulding Lower Bar.
3) Sommer & Maca Industries, Inc.; Heavy Gauge Aluminum Shallow Nose "J" Moulding Lower Bar.

2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.062 inch (1.57 mm).

a. Products: Subject to compliance with requirements, provide one of the following:

1) Laurence, C. R. Co., Inc.; CRL Deep "J" Channel.
2) Sommer & Maca Industries, Inc.; Aluminum Deep Nose "J" Moulding Upper Bar.
3) Sommer & Maca Industries, Inc.; Heavy Gauge Aluminum Deep Nose "J" Moulding Lower Bar.

3. Finish: Clear bright anodized.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Sizes: To suit Project conditions, and before tempering**,** cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Mirrors shall be installed flush with face of tile.

C. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

D. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
2. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area

END OF SECTION 08 83 00

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SECTION 08 87 17 - SAFETY AND SECURITY GLAZING FILMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing film applied to new glazing assemblies.

B. New Glazing: Factory or shop install film to glazing before installation in frames.

C. Glazing assemblies to receive film are indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: New doors with glazing to receive film.

B. Section 08 41 13 - Aluminum Framed Entrances and Storefronts: New glazing to receive film.

D. Section 08 80 00 - Glazing: New glazing to receive film (as indicated on drawings).

1.03 ABBREVIATIONS AND ACRONYMS

A. CFR - Code of Federal Regulations.

B. GSA - General Services Administration.

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.

D. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

F. GSA TS01 - Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings; General Services Administration; 2003.

1.05 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Record of product certification for safety requirements.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings: Detailing installation of film, anchoring accessories, and sealant.

D. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.

E. Samples, Supplemental Anchors: Where supplemental anchors are necessary to achieve specified performance submit detailed information in accordance with substitution procedures; include two samples, minimum length 2 inches.

F. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.

G. Specimen Warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of safety glazing films with minimum 10 years successful experience.

B. Installer Qualifications: Certified by glazing film manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01 77 01 - Closeout Submittals, for additional warranty requirements.

B. Provide 10 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: ArmoredOne 23 mil #AOTSF23, by Armored One LLC, 386 N Midler Ave, Syracuse, NY 13206, www.armoredone.com/contact/

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS

A. Security Glazing Film (applied on the interior):

1. Transparent polyester film for permanent bonding to glass.

2. Final installed product must be a minimum of 0.023 inches (23 Mil) thick.

a. Installing multiple layers of thinner film to accomplish the required thickness is not allowed.

3. Adhesive Type: Pressure sensitive.

4. Tensile Strength: ASTM D-882, 32,000 psi minimum.

5. Breaking Strength: ASTM D-882, 640 lbs. / inch.

6. Elongation at Break: ASTM D-882, 230%

7. Haze: ASTM D1003, <4%
8. Color b: ASTM D2244, 4.2
9. Visible Light Transmission: 87%
10. Visible Light Reflected (Int): 12%
11. Visible Light Reflected (Ext): 12%
12. UV Block:>99%
13. Total Solar Energy Reflected: 11%
14. Total Solar Energy Transmitted: 77%
15. Total Solar Energy Absorbed: 12%
16. Shading Coefficient: 0.93
17. Total Solar Energy Rejected: 19%
18. Solar Heat Gain Coefficient: 0.81
19. U-Value Winter: 1.03
20. K-Value Winter: 5.85
21. Glare Reduction: 3%
22. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84 (Class A).

B. Provide supplemental anchoring system as required to meet forced entry resistance requirements.

C. Light Transmission of Film Applied on 1/4-inch-Thick Clear Annealed Glass:

1. Visible light Transmittance: 86 percent.

D. Anchoring System: DOW 995 or GE SCS2000 SilPruf Structural Sealant with high impact styrene trim.

PART 3 EXECUTION

3.1 EXAMINATION

A. Field -Applied Film: Verify that existing conditions are adequate for proper application and performance of film.

B. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.

C. Verify glass is not cracked, chipped, broken, or damaged.

D. Verify that frames are securely anchored and free of defects.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

C. Protect adjacent surfaces.

D. Do not begin installation until substrates have been properly prepared.

3.3 INSTALLATION

A. Do not apply glazing film when surface temperature is less that 40 degrees F or if precipitation is imminent.

B. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

C. Accurately cut film with straight edges to required sizes allowing 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required by anchorage method.

D. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.

E. Supplemental Anchors: Install in accordance with manufacturer's instructions and shop drawings.

F. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.

G. Remove labels and protective covers.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 08 87 17

SECTION 09 21 16 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

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 performance criteria, materials, production, and erection of gypsum board shaft wall assemblies for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all gypsum board shaft wall assemblies as required by this section, schedules, keynotes and drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM 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: 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.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: As indicated per UL Listing.

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 or as indicated.

E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

F. Elevator Hoistway Entrances: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches (76 mm), matching studs in depth, and not less than 0.033 inch (0.84 mm) thick.

G. Room-Side Finish: As indicated.

H. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

I. 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, available products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum; Shaft Liner.
b. CertainTeed Corp.; ProRoc Shaftliner.
c. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
e. USG Corporation; Sheetrock Brand Gypsum Liner Panel.

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, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; ProRoc Moisture and Mold Resistant Shaftliner.
b. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; Dens-Glass Ultra Shaftliner.
c. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
d. 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 09 29 00 "Gypsum Board."

E. Cementitious Backer Units: As specified in Division 09.

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: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120) unless otherwise indicated.

B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fire Trak Corp.; Fire Trak System.
    b. Grace Construction Products; FlameSafe FlowTrak System.
    c. Metal-Lite, Inc.; The System.
    d. Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes 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: As specified in Division 09 "Gypsum Board."

F. Acoustical Sealant: As specified in Division 09 "Gypsum Board."

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 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 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.

1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
2. 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. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints at locations indicated on Drawings, according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. 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.

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.

3.4 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.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area

END OF SECTION 09 21 16

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. None

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners and firestop tracks, from ICC-ES.

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), Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:

a. Thickness: 20 ga. **Unless otherwise indicated**
b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, 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 friction fit into top runner and with continuous bridging 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 or approved equal:

1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
2) MBA Building Supplies; FlatSteel Deflection Track or Slotted Deflecto Track.
3) Steel Network Inc. (The); VertiTrack VTD Series.
4) Superior Metal Trim; Superior Flex Track System (SFT).
5) Telling Industries; Vertical Slip Track.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following, or approved equal:

a. Fire Trak Corp.; Fire Trak System.
b. Grace Construction Products; FlameSafe FlowTrak System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0219 inch (0.556 mm).

F. 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: As indicated on Drawings.
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.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0219 inch (0.556 mm).
2. Depth: 7/8 inch (22.2 mm).

H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type 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.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (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.
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.

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.
3. Dimpled Steel Studs and Runners: ASTM C 645.
4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

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.
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.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

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.

3.4 INSTALLING FRAMED ASSEMBLIES

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

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches (406 mm)] o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (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.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

G. 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 according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

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

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

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

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

F. 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.

G. 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.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

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 performance criteria, materials, production, and erection of gypsum board for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all gypsum board as required by this section, schedules, keynotes and drawings including, but not limited to the following.

1. Interior gypsum board.
2. Abuse and impact resistant gypsum board at specific locations.
3. Moisture resistant gypsum board (all wet locations and as tile backer)
4. Trim.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 09 22 16 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
3. Section 09 21 16 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ceiling Suspension Systems: Ceiling suspension systems and cantilevered ceiling soffits shall withstand the effects of gravity and seismic effects.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings for Gypsum Board Ceiling Systems: Include reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, and as reviewed by a qualified professional engineer using input from installers of the items involved:.

1. Layout of all ceilings/soffits with dimensions based on as-built construction
2. Gypsum board ceiling suspension-system members.
3. Miscellaneous metal/steel framing sizing for soffits and cantilevers
4. Method of attaching hangers to building structure.

a. Furnish layouts and sizing for cast-in-place anchors, clips, metal framing, miscellaneous steel shapes, and other ceiling attachment devices whose installation is specified in other Sections.

5. Size and location of initial access modules for suspended gypsum board ceilings and soffits.
6. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
7. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96) for layout drawings, 1 inch = 1 foot for detail drawings

C. Evaluation Reports: For each ceiling suspension system and anchor and fastener type, from ICC-ES.

D. Field quality-control reports.

E. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
2. Textured Finishes: 12” x 12” sample for each textured finish indicated and on same backing indicated for Work.

1.5 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.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.
b. Each texture finish indicated.

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.

1.6 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.

1.7 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.

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 the following:

1. National Gypsum Company
2. American Gypsum.
3. CertainTeed Corp.
4. Georgia-Pacific Gypsum LLC.
5. Lafarge North America Inc.
6. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

D. 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.

E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

F. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M. **(At interior of all exterior walls and whiteboard walls)**

1. Products Paper Faced, ASTM C 1396: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. National Gypsum Company; Hi-Abuse XP.
2. Products Glass-Mat Faced, ASTM C 1658: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. National Gypsum Company; eXP Interior Extreme AR Gypsum Panel.
3. Core**:** 5/8 inch (15.9 mm), Type X.
4. Long Edges: Tapered.
5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
6. Surface Abrasion Resistance: Level 3 in accordance with ASTM C 1629.
7. Indentation Resistance: Level 1 in accordance with ASTM C 1629.
8. Soft Body Impact Resistance: Level 2 in accordance with ASTM C 1629.

G. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M. **(At all lobbies, entries, corridors, gymnasium/ fitness room)**

1. Products Paper Faced, ASTM C 1396: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. National Gypsum Company; Hi-Impact XP.
2. Products Glass-Mat Faced, ASTM C 1658: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Georgia-Pacific Gypsum LLC; DensArmor Plus Impact-Resistant Interior Panel.
   b. National Gypsum Company; eXP Interior Extreme IR Gypsum Panel.
3. Core**:** 5/8 inch (15.9 mm), Type X.
4. Long Edges: Tapered.
5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
6. Surface Abrasion Resistance: Level 3 in accordance with ASTM C 1629.
7. Indentation Resistance: Level 1 in accordance with ASTM C 1629.
8. Soft Body Impact Resistance: Level 3 in accordance with ASTM C 1629.
9. Hard Body Impact Resistance: Level 2 in accordance with ASTM C 1629.

H. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces. **(At all bathroom locations)**

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.

I. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use, where indicated on Drawings. **(At all plumbing walls, with or without tile)**

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. Georgia-Pacific Gypsum LLC; DensArmor Plus.
    b. National Gypsum Company; eXP Interior Extreme.

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

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints**,** rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating 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. 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.

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: Comply with mineral-fiber requirements of assembly.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide product by one of the following:

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Pecora Corporation
d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
e. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 07 21 00 "Thermal Insulation."

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 and Gypsum Association GA 214-10.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (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.

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. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings and at all fire rated assemblies.
3. Flexible Type: As indicated on Drawings.
4. Ceiling Type: As indicated on Drawings.
5. Abuse-Resistant Type: At interior of exterior walls and whiteboard walls.
6. Impact-Resistant Type: At lobbies, entries and corridors
7. Moisture- and Mold-Resistant Type: As indicated on Drawings and at all wet areas and as tile backer.
8. Glass-Mat Interior Type: At all plumbing wall with or without tile.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. 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. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical

joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (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 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 at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use at outside corners.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges and where indicated.
6. Curved-Edge Cornerbead: Use at curved openings.

3.5 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 and Gypsum Association GA 214-10:

1. Level 1:

    a. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Minor tool marks and ridges are acceptable:

        1) At ceiling plenum areas, concealed areas, behind metal lockers, behind built-in millwork, and where indicated.

2. Level 2:

    a. All joints and interior angles shall have tape embedded in joint compound and wiped with joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Minor tools marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level:

        1) At gypsum panels that are substrate for tile or acoustical tile, and where indicated on Drawings.

3. Level 3:

    a. All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with joint knife leaving a thin coating of joint compound over all joints and interior angles. One additional coat of joint compound shall be applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges:

        1) At panel surfaces receiving medium- or heavy-textured finishes before painting, or heavy wallcoverings where lighting conditions are not critical, and where indicated on Drawings.

4. Level 4:

    a. All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Prepared surfaces shall be coated with drywall primer prior to application of final finishes:

        1) At panel surfaces receiving light-textured finishes, wallcoverings, and flat paints, and at panel surfaces that will be exposed to view unless otherwise indicated. This is generally the standard exposed finish, unless noted otherwise. Not recommended where glossy or semi-glass enamel paints are specified.

    b. Primer and its application to surfaces are specified in other Section 099123 “Painting.”

5. Level 5:

a. All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, applied to entire surface. The surface shall be smooth and free of tool marks and ridges. Prepared surfaces shall be coated with drywall primer prior to application of final finishes:

1) At panel surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting, and where indicated on Drawings.

b. Primer and its application to surfaces are specified in other Section 099123 "Painting."

3.6 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.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Ceramic tile.
   2. Porcelain tile.
   3. Stone thresholds installed as part of tile installations.

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board Assemblies" for glass mat, water resistant gypsum backing board installed in gypsum wallboard assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.

B. Load-Bearing Performance: For ceramic tile installed on walkway surfaces, provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:
   1. Moderate: Passes cycles 1 through 10.

1.4 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, and other products specified.

B. Shop Drawings: For the following:
   1. Tile patterns and locations.
   2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
   1. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
   2. Full-size units of each type of trim and accessory for each color required.
   3. Stone thresholds in 6-inch lengths.

E. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

F. 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 of architects and owners, and other information specified.

G. Setting Material Test Reports: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
   1. Stone thresholds.
   2. Joint sealants.

1.6 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.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Tile Products:
      a. American Olean Tile Company.
      b. Crossville Tile
      c. ProSpec LLC.
      d. Dal-Tile Corporation.
      e. Emser Tile
      f. Stone Source
      g. Horizon Tile

B. Tile-Setting and -Grouting Materials:
      a. American Olean Tile Company.
      b. ProSpec LLC.
      c. Bostik.
      d. Dal-Tile Corporation.
      e. Laticrete International, Inc.
      f. Mapei Corporation.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

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. See Finish Schedule for exact tile product information.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.
1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.

2.3 WALL TILE

A. Porcelain Wall Tile Basis of Design: Dal-Tile “Color Wave” tile complying with the following requirements:

1. Composition: Porcelain.
2. Module Size: 12x24. Refer to Finish Schedule
3. Thickness: 5/16 inch.
4. Colors: As noted on finish schedule.
5. Pattern and Borders: Contrasting color patterns and borders as directed by the Architect

B. Trim Units: Provide tile trim units to match color and characteristics of adjoining flat tile and to comply with the following requirements:
1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
   a. Round Incorner Base for Thin-Set Mortar Installations: Coved.
   b. Wainscot Cap for Thin-Set Mortar Installations: Stainless steel trim.
   c. External Corners for Thin-Set Mortar Installations: Stainless steel trim.
   d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

2.4 STONE THRESHOLDS (NOT USED)

A. General: Provide stone thresholds that are uniform in color and finish, fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces.
1. Fabricate thresholds to heights indicated, but not more than 1/2 inch above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and with a minimum abrasive-hardness value of 10 per ASTM C 241.
1. As selected from manufacturer’s standard colors and finishes.

2.5 SETTING MATERIALS

A. Organic Adhesive: ANSI A136.1, Type I as recommended by manufacturer.

B. Tile Setting Adhesive: Elastomeric, waterproof, liquid applied.

2.6 GROUTING MATERIALS

A. Dry-Set Grout: ANSI A118.6, color as selected from the manufacturer's standard range of colors.

2.7 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. Walls: One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

D. Floors: Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

E. Available Products: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:
   1. One-Part, Mildew-Resistant Silicone Sealants:
      a. Dow Corning 786; Dow Corning Corporation.
      b. Sanitary 1700; GE Silicones.
      c. Pecora 898 Sanitary Silicone Sealant; Pecora Corp.
      d. Rhodorsil 6B White; Rhone-Poulenc, Inc.
      e. Tremsil 600 White; Tremco, Inc.
   2. Multipart, Pourable Urethane Sealants:
      a. Chem-Calk 550; Bostik.
      b. Vulkem 245; Mameco International, Inc.
      c. NR-200 Urexpan; Pecora Corp.
      d. THC-900; Tremco, Inc.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. 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.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.10 FINISHING AND EDGE PROTECTION FOR WALLS

A. Install stainless steel edge trim at horizontal and vertical corners of tile installations. Profiles for each location to be selected by Architect.

B. Basis of Design: Schluter Systems, Plattsburgh, N.Y.
   1. Bullnose
   2. Straight profile with anchoring leg
   3. Rounded outer corner with anchoring leg

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
   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 joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so 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.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with required TCA installation methods.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. 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 plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the 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 indicated.
1. For tile mounted in sheets (if any), make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Locate joints in tile surfaces directly above joints in concrete substrates.

H. Grout tile to comply with the requirements of the following tile installation standards:
1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch.
   2. Wall Tile: 1/16 inch.

3.5 EDGE PROTECTION INSTALLATION FOR WALLS

A. Install as per manufacturer's instructions as an integral component during wall tile installation.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement 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 written instructions, but no sooner than 10 days after 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 ensure tile is without damage or deterioration at the time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove any cleaner from tile surfaces.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 09 30 13

09 50 00 ACOUSTICAL WOOD CEILING PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

a) Section Includes:

1. WoodWorks Grille-Forté Veneered Wood Ceiling Panels with Centered Notched and Flat Backers
2. Exposed grid suspension system.
3. Wire hangers, fasteners, main runners, cross tees, wall angle moldings and accessories.

b) Related Sections:

1. Section 09 53 00 - Acoustical Ceiling Suspension Assembly
2. Section 09 20 00 - Plaster and Gypsum Board
3. Section 09 22 16 - Non-Structural Metal Framing
4. Divisions 23 (15) - HVAC
5. Division 26 (16) Sections - Electrical Work

c) Alternates

1. Prior Approval: Unless otherwise provided for in the Contract documents, submit proposed product substitutions no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review and acceptance. Approved products will be set forth by the Addenda. If a substitution is included in a Bid and is not approved by an Addendum, the specified products shall be provided as in place of the substitute without additional compensation.
2. Submittals, which do not provide adequate data for the product evaluation, will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); panel design, size, composition, color, and finish; suspension system component profiles and sizes; compliance with the referenced standards.

1.3 REFERENCES

a) American Society for Testing and Materials (ASTM):

1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot- Dip Process.

3. ASTM A 1008 Standard Specification for Steel, Sheet, and Cold Rolled Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
4. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
5. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
6. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E 580 Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.
8. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
9. ASTM E 1264 Classification for Acoustical Ceiling Products.
10. Hardwood Plywood & Veneer Association (HPVA)
11. International Building Code
12. ASHRAE Standard 62 1 2004 Ventilation for Acceptable Indoor Air Quality
13. NFPA 70 National Electrical Code
14. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
15. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
16. International Code Council-Evaluation Services Report - Seismic Engineer Report
    A. ESR 1308 - Armstrong T-Bar or Dimensional Suspension
17. California Air Resources Board (CARB) compliant
18. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

1.4 SUBMITTALS

a) **Shop Drawings:** Layout and details of ceilings. Show locations of items that are to be coordinated with or supported by the ceilings.

b) **Installation Instructions:** Submit manufacturer's installation instructions as referenced in Part three, Installation.

c) **Product Data:** Submit manufacturer's technical data for each type of ceiling unit and suspension system required.

d) **Samples:** 4-1/4"x 7"x 3/4 – Real Wood Veneer on fire rated particle board– Semi-gloss tinted topcoat – Clear Finish

e) **Certifications:** Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

f) **Non-Conformance:** All products not conforming to the requirements of this specification and or the manufacturer's published values are to be disposed. The Contractor performing the work will replace with approved product at their expense.

1.5 QUALITY ASSURANCE

a) Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer.

b) Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E-84 and complying with ASTM E 1264 for Class A products.
2. HPVA (Hardwood Plywood and Veneer Association) certification and audit program per ASTM E-84 tunnel test.

c) Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

d) Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

a) Store ceiling components in a dry interior location in their cartons prior to installation to avoid damage. Store cartons in a flat, horizontal position. The protectors between the panels should not be removed until installation.

b) Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Panels must not be exposed to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

c) Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

1.7 PROJECT CONDITIONS

a) Wood ceiling materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation. (Remove plastic wrap to allow panels to climatize).

b) The wood panels should not be installed in spaces where the temperature or humidity conditions vary from the temperatures and conditions that will be normal in the occupied space.

c) As interior finish products, the veneered panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed, and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.8 WARRANTY

a) Veneered Wood Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

    1. Veneered Wood Panels: Defects in materials or factory workmanship.
    2. Grid System: Rusting and manufacturing defects.

b) Warranty Period:

    1. Veneered Wood panels: One (1) year from date of installation.
    2. Grid: Ten years from date of installation.

c) 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 the requirements of the Contract Documents.

1.9 MAINTENANCE

a) Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

    1. Ceiling Units: Furnish quality of full-size units equal to 2.0 percent of amount installed.
    2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 1.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

a) Basis of Design Armstrong WoodWorks Grille - Forte' Veneered Ceilings Panels:

    1. Armstrong World Industries, Inc.
    2. Or approved Equal

b) Suspension Systems:

    1. Armstrong World Industries, Inc.
    2. Or approved Equal

2.2.0 WOOD CEILING UNITS

a) Ceiling Panels Type WD-1:

    1. Surface Texture: Smooth
    2. Composition: Real wood veneer on fire rated particle board
    3. Finish(s): Real Wood Veneer
        - Vertical Grain Fir (NVF)
    4. Panel Width: 12-inch

Panel Length Size(s): With 1" reveal panel to panel @ length

- 48-inch (Nominal): 47-inch (Actual)

Slat Width 3/4-inch:

Height – Number of Slats (Spacing) [item#]

1) 2-1/2" –6 Slats (1-1/4") [6336L_S14---]

5. Acoustical Performance Infill Options:
    1) Calla Square Layin panel - Item 2820BK – NRC 0.85, CAC 35
6. Flame Spread:

   Class A: ASTM E84 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less.

   CAN/ULC S102 surface burning characteristics. Flame Spread Rating 25 or less. Smoke Developed Classification 50 or less.
7. Acceptable Product: WoodWorks Grille Forté Veneered Panels –items 6333L_ S14-S17, 6334L_S14-S14, 6335L _S14_S17, 6336L_S14-S16 as manufactured by Armstrong World Industries.

b) Accessories:
    1. Backer Clip - item 5687
    2. Flat Backer Kit - item7920GBL
    3. Heavy Duty Wall Anchor – item 7100

2.2.1 SUSPENSION SYSTEMS

c) Components: All main beams and cross tees shall be commercial quality hot dipped galvanized steel as per ASTM A653. Main beams and cross tees are double-web steel construction with 15/16-inch type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
    1. Structural Classification: ASTM C635 (Heavy Duty).
    2. Color: Tech Black.
    3. Acceptable Product: Prelude XL 15/16" Exposed Tee Main beam item 7301BL, Prelude XL Exposed Tee item XL7341BL, Prelude XL Exposed Tee 2' item XL7328BL as manufactured by Armstrong World Industries, Inc.

d) Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

e) Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least times-three design load, but not less than 12 gauge.

f) Accessories/Edge Moldings and Perimeter Trim:

a. 7/8” Angle Wall Molding - item7800BL
b. 4” Veneered Trim with 4 Clips – item 6481F07W1H4---(Finish Suffix)
c. 6” Veneered Trim with 4 Clips – item 6481F07W1H6---(Finish Suffix)
d. 8” Veneered Trim with 4 Clips – item 6481F07W1H8---(Finish Suffix)
e. Replacement Trim Clip – item 5925
f. Adjustable Trim Clip – item 7239
g. Axiom Vector Straight Trim - Recommend in Black 6” and up – AX_STR (Finish)
h. WoodWorks Edgebanding – item 6408---(Finish Suffix)

PART 3 - EXECUTION

3.1 EXAMINATION

a) Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.

b) Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.2 PREPARATION

a) Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

b) WoodWorks ceiling materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation. (Remove plastic wrap to allow panels to climatize).

3.3 INSTALLATION

a) Interior WoodWorks products, the veneered wood panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed, and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

b) Install suspension system and panels in compliance with ASTM C636, ASTM E580, with the approval of the authorities having jurisdiction, and in accordance with the manufacturer’s WoodWorks Grille Forté Veneered Installation Instructions.

3.4 ADJUSTING AND CLEANING

a) Replace damaged and broken panels.

b) Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer’s instructions for cleaning and touch up of minor finish damage.

END OF SECTION 09 50 00

09 50 01 ACOUSTICAL WOOD CEILING PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

a) Section Includes:

1. WoodWorks Grille- Forté Veneered Wall Panels with Centered Notched and Flat Backers
2. Wire hangers, fasteners, main runners, cross tees, wall angle moldings and accessories.

b) Related Sections:

1. Section 09 20 00 - Plaster and Gypsum Board
2. Divisions 23 (15) - HVAC
3. Division 26 (16) Sections - Electrical Work

c) Alternates

1. Prior Approval: Unless otherwise provided for in the Contract documents, submit proposed product substitutions no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review and acceptance. Approved products will be set forth by the Addenda. If a substitution is included in a Bid and is not approved by an Addendum, the specified products shall be provided as in place of the substitute without additional compensation.
2. Submittals, which do not provide adequate data for the product evaluation, will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); panel design, size, composition, color, and finish; suspension system component profiles and sizes; compliance with the referenced standards.

1.3 REFERENCES

a) American Society for Testing and Materials (ASTM):

1. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
3. Hardwood Plywood & Veneer Association (HPVA)
4. International Building Code
5. ASHRAE Standard 62 1 2004 Ventilation for Acceptable Indoor Air Quality

6. NFPA 70 National Electrical Code
7. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
8. California Air Resources Board (CARB) compliant
9. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

1.4 SUBMITTALS

a) **Shop Drawings:** Layout and details of walls. Show locations of items that are to be coordinated with or supported by the walls.

b) **Installation Instructions:** Submit manufacturer's installation instructions as referenced in Part three, Installation.

c) **Product Data:** Submit manufacturer's technical data for each type of wall unit and framing structure required.

d) **Samples:** 4-1/4"x 7"x 3/4 – Real Wood Veneer on fire rated particle board - Semi-gloss tinted topcoat – Clear Finish

e) **Certifications:** Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

f) **Non-Conformance:** All products not conforming to the requirements of this specification and or the manufacturer's published values are to be disposed. The Contractor performing the work will replace with approved product at their expense.

1.5 QUALITY ASSURANCE

a) Single-Source Responsibility: Provide wall panel units and grid components by a single manufacturer.

b) Fire Performance Characteristics: Identify wall components with appropriate markings of applicable testing and inspecting organization.

   1. Surface Burning Characteristics: As follows, tested per ASTM E-84 and complying with ASTM E 1264 for Class C products.
   2. HPVA (Hardwood Plywood and Veneer Association) certification and audit program per ASTM E-84 tunnel test.

c) Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

d) Coordination of Work: Coordinate wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

a) Store wall components in a dry interior location in their cartons prior to installation to avoid damage. Store cartons in a flat, horizontal position. The protectors between the panels should not be removed until installation.

b) Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Panels must not be exposed to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

c) Handle wall units carefully to avoid chipped edges or damage to units in any way.

1.7 PROJECT CONDITIONS

a) Wood wall materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation. (Remove plastic wrap to allow panels to climatize).

b) The wood panels should not be installed in spaces where the temperature or humidity conditions vary from the temperatures and conditions that will be normal in the occupied space.

c) As interior finish products, the Veneered wood panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed, and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.8 WARRANTY

a) WW Grille- Forté Veneered Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

    1. WW Grille Forté Veneered Panels: Defects in materials or factory workmanship.

b) Warranty Period:

    1. WW Grille Forté Veneered Panels: One (1) year from date of installation.

c) 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 the requirements of the Contract Documents.

1.9 MAINTENANCE

a) Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

    1. Wall Units: Furnish quality of full-size units equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

a) Basis of Design WoodWorks Grille Forte' Veneered Walls Panels:

1. Armstrong World Industries, Inc.
2. Or approved Equal

2.2.0 WOOD WALL UNITS

a) Wall Panels Type AP-1:

1. Surface Texture: Smooth
2. Composition: Real wood veneer on fire rated particle board
3. Finish(s): Real Wood Veneer
   - Vertical Grain Fir (NVF)

   Custom finishes available
4. Panel Width: 12-inch

   Panel Length Size(s): With 1" reveal panel to panel @ length
   - 96-inch (Nominal): 95-inch (Actual)
5. Panel Length Size(s): 95-inch (Actual) With 1" reveal panel to panel @ length

   <u>Slat Width 3/4-inch:</u>

   Height – Number of Slats (Spacing) [item#]

   1) 2-1/2" –4 Slats (2-1/4") [6334L_S14---]
6. Flame Spread:

   Class A: ASTM E84 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less.
   CAN/ULC S102 surface burning characteristics. Flame Spread Rating 25 or less. Smoke Developed Classification 50 or less.
7. Acceptable Product: WoodWorks Grille- Forté Veneered Panels – items 6333L_ S14--- and 6334L_ S14---, as manufactured by Armstrong World Industries.

2.2.1 SUSPENSION SYSTEMS

a) Refer to Armstrong Grille Forte Wall Installation Instruction (Section 4.2)

b) Accessories and Perimeter Trim:

a. Flat Backer Kit - item7290GBL
b. 4” Veneered Trim with 4 Clips – item 6481F07W1H4---(Finish Suffix)
c. 6” Veneered Trim with 4 Clips – item 6481F07W1H6---(Finish Suffix)
d. 8” Veneered Trim with 4 Clips – item 6481F07W1H8---(Finish Suffix)
e. Replacement Trim Clip – item 5925
f. Axiom Vector Straight Trim - Recommend in Black 6” and up – AX_STR (Finish)
g. WoodWorks Edgebanding – item 6408---(Finish Suffix)

PART 3 - EXECUTION

3.1 EXAMINATION

a) Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.

b) Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.2 PREPARATION

a) Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Avoid use of less than half width units at borders and comply with wall elevations. Coordinate panel layout with mechanical and electrical fixtures.

b) WoodWorks wall materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation. (Remove plastic wrap to allow panels to climatize).

3.3 INSTALLATION

a) Interior WoodWorks products, the veneered wood panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed, and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

3.4 ADJUSTING AND CLEANING

a) Replace damaged and broken panels.

b) Clean exposed surfaces of walls panels, including trim, edge moldings, and suspension members. Comply with manufacturer’s instructions for cleaning and touch up of minor finish damage.

END OF SECTION 09 50 01

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SECTION 09 51 23 - ACOUSTICAL CEILING TILES

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 performance criteria, materials, production, and erection of continuous/wall-to-wall acoustical tile ceilings for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all acoustical tile ceilings as required by the this section, schedules, keynotes and drawings, including, but not limited to the following:

1. Acoustical tiles for ceilings.
2. Exposed grid suspension systems.
3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.
4. Perimeter trim

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6-inches- (150-mm-) in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch- (150-mm-) long Sample of each type.
3. Exposed Moldings and Trim: Set of 6-inch- (150-mm-) long Samples of each type and color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in 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. Acoustical Ceiling Units: Full-size tiles equal to **2** percent of quantity installed.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to **2** percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

B. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

C. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either

toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

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

1. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.10 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
1. Acoustical Panels: Sagging and warping
2. Grid System: Rusting and manufacturer's defects
3.

B. Warranty Period:
1. Acoustical panels: Ten (10) years from date of substantial completion.
2. Grid: Ten (10) years from date of substantial completion.
3. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is Thirty (30) years from date of substantial completion.

C. 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 the requirements of the Contract Documents.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design and size components to withstand seismic loads in accordance with the minimum established by ASTM C636.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. 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 ACOUSTICAL TILES, GENERAL

A. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent (refer to specific acoustic tile).

C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

E. Provide glass-fiber based panels made with binder containing no urea formaldehyde.

2.3 ACOUSTICAL TILES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Industries products as indicated on Drawings or comparable product by one of the following:
1. CertainTeed Corp.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. ACT-1: Armstrong **Fine Fissured High-NRC**, 1754 (Classrooms/Corridors or as indicated in drawings)
1. ASTM E1264 Classification – Type IV, Form 2, Pattern C E, Fire Class A
2. Composition: Wet-formed mineral fiber
3. Color: White
4. Size: 24in x 24in x 7/8in
5. Edge Profile: Square Lay-In for interface with AL Prelude 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton; minimum rating = 0.75
7. Ceiling Attenuation Class: (CAC); ASTM C 1414; Classified with UL label (class A) on product carton; minimum rating = 35
8. Fire Performance: ASTM E84 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less (UL labeled).
9. Humidity/ Sag Resistance
10. Anti Mold/ Mildew & Bacteria: Coating containing mold-inhibiting agent that resists the growth of mold and mildew

C. ACT-2: Armstrong **Fine Fissured High-NRC**, 1755 (Classrooms/Corridors or as indicated in drawings)
1. ASTM E1264 Classification – Type IV, Form 2, Pattern C E, Fire Class A
2. Composition: Wet-formed mineral fiber
3. Color: White
4. Size: 24in x 48in x 7/8in
5. Edge Profile: Square Lay-In for interface with AL Prelude 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton; minimum rating = 0.75
7. Ceiling Attenuation Class: (CAC); ASTM C 1414; Classified with UL label (class A) on product carton; minimum rating = 35
8. Fire Performance: ASTM E84 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less (UL labeled).
9. Humidity/ Sag Resistance
10. Anti Mold/ Mildew & Bacteria: Coating containing mold-inhibiting agent that resists the growth of mold and mildew

D. ACT-3: Armstrong Kitchen Zone Panels (Kitchens / Food Preparation Areas, Cafeterias or as indicated in drawings).
1. Surface Texture: Fine.

2. Composition: Wet-Formed Mineral Fiber
3. Color: White.
4. Size: 24IN x 48IN
5. Edge Profile: Square 15/16IN for interface with Prelude 15/16" Suspension system
6. Noise Reduction Coefficient(NRC): ASTM C 423; Classified with UL label on product carton 0.95.
7. Ceiling Attenuation Class (CAC): 33
8. Sabin: N/A
9. Articulation Class (AC): ASTM E 1111; 190.
10. Flame Spread: ASTM E 1264; Type A, Form A2.2, Pattern G; Fire Class A
11. Light Reflectance White Panel: ASTM E 1477; 0.89
12. Dimensional Stability: HumiGuard Plus.
13. Recycle Content: Post-Consumer - 12% Pre-Consumer Waste - 59%.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

C. 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/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.5 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, Armstrong product or provide comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Pair suspension systems with the following ACT and ATC types:
   1. ACT-1, 2 and 3: 15/16 inch Prelude XL

C. Direct-Hung, Double-Web Suspension System Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
   a. Structural Classification: ASTM C 635 Intermediate Duty
   b. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
   c. Acceptable Product: Suprafine XL 9/16" Exposed Tee and Prelude 15/16” Tee as manufactured by Armstrong World Industries

D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

E. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.
   1. Access: Upward and end pivoted or side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers – Basis of Design: Subject to compliance with requirements, Armstrong product or provide comparable product by one of the following:
   1. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Products – 2” Axiom trim, or equal

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

   1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:

   1. Acoustical Sealant for Exposed and Concealed Joints:

      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. Henkel Corporation; OSI Sealants Pro-Series SC-175 Rubber Base Sound Sealant.
b. Pecora Corporation; AIS-919.
c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. 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.
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 and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.

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 (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 09 51 23

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SECTION 09 64 66 – WOOD GYMNASIUM FLOORING

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 document specifies a wood strip athletic floor system consisting, in general, of wood subflooring, maple flooring, vapor retarder, vertical restraints, sanding, sealers, finishes, game lines, and wall base.
   1. Contractor shall provide all manufacturer recommended floor transitions to adjacent floor levels and finishes.

B. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of gymnasium flooring as required by this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including samples of materials.

B. Product Schedule: Use same designations indicated on Drawings.

C. Submit project shop drawings for floor plans, including all manufacture standard details, insert details, wall base details, coordination with electrical devices, game line striping, etc.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. No extra material to be purchased for purpose of attic stock. All left over material from construction to constitute attic stock – store, maintain and protect accordingly. Package with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. The flooring contractor shall be an Accredited Installation Company with MFMA Accredited Installer(s) on-site for the duration of the wood floor installation; or, a contractor approved by Flooring manufacturer.

B. Flooring shall be stored on the premises before installation commences as required for acclimation. Final determination as to acclimation will be made by the flooring contractor.

C. System shall meet necessary DIN/EN and MFMA requirements.

D. Warranty: The materials supplied will be free from manufacturing defects for a period of one year.

1.7 DELIVERY, STORAGE, AND HANDLING

A. The floor system shall not be delivered or installed until the concrete slab is properly cured and all masonry, plastering, tile work and overhead mechanical trades are completed and building is permanently enclosed and weathertight.

1.8 FIELD CONDITIONS

A. Permanent heat, light and ventilation shall be installed and operative during and after installation, maintaining a temperature range of 55o F (13 o C) to 75o F (24 o C) and a relative humidity range that changes no more than 15% from low to high humidity levels.

B. HVAC System shall be operating in balance at levels and conditions consistent with those during permanent occupancy.

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 48 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

F. Do not install flooring over concrete slabs until they are sufficiently cured and dry to achieve a bond with the adhesive in accordance with the manufacturer’s recommended bond and moisture tests.

PART 2 - PRODUCTS

2.1 WOOD GYMNASIUM FLOORING

A. Basis of Design: Subject to compliance with requirements, provide the product indicated on drawings or comparable product to the following: **Alliance™** sports floor system as provided by **Connor Sports Flooring, www.connorfloor.com, (800-833-7144).**).
   1. Other manufacturers (approved equal) may be acceptable, provided substitution meets all of the basis of design specified criteria:
      a. Action Floor Systems LLC.
      b. Signature Sports Flooring.
      c. Hornet Sports Flooring

B. Vapor Barrier - 6-mil polyethylene.

C. Subfloor
1. Factory assembled Green Play subfloor panels with Rezill pads attached.

D. Flooring (Connor Laytite Maple)
1. 25/32" X 2-1/4", Second & Better Grade, Northern Hard Maple Flooring, TGEM, MFMA Grade marked and stamped as manufactured by Connor Sports Flooring, Amasa, MI.

E. Fasteners
1. Flooring Fasteners
a. Maple Surface - Minimum 2" (51mm) barbed cleats or coated staples.
2. Subfloor Fasteners
a. 1" (25mm) coated staples or nails
b. PL400 Adhesive or equal
3. Concrete
a. Secure Grip Technology Adhesive & Anchors
b. Rawl Spike– minimum 2" (51mm), washer, and bushing

F. Finish Materials - Connor oil modified polyurethane seal and finish or equal.

G. Game Lines:
1. Apply game lines and School Logo compatible with finish.

H. Wall Base - 3" X 4", heavy duty, molded, vented cove base with pre-molded outside corners.

2.2 INSTALLATION MATERIALS

A. Adhesives: As recommended by manufacturer to meet site conditions.

B. Floor Polish: Provide protective, liquid floor-polish products recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to flooring manufacturer's written instructions.

B. Concrete Substrates: Prepare according to manufacturer's written instructions.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Floor covering shall not be installed over expansion joints.

E. Do not install flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 WOOD GYMNASIUM FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installation.

B. Subfloor:
1. Cover concrete with poly, sealing and lapping joints a minimum of 6”.

2. Arrange subfloor assemblies at right angle to finish flooring with adjacent nailing rows set 12” on center, and 11” on center for 3rd Grade and 3rd/Better Grade flooring. Lap panel ends, providing 1/4” end joint spacing, and secure with nails or staples and construction adhesive. Place alternate rows of subfloor panels to nest evenly within adjacent panel rows. Assure that nailing end joints do not align with nailing end joints of adjacent subfloor assembly rows. Provide 1-1/2” expansion voids at perimeter and at vertical obstructions. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.

3. Secure panels to concrete with steel channel sections and anchorage pins fixed at every other panel joint along subfloor assemblies, and alternate side location of channel sections at each placement. Position channel sections in adjacent subfloor assemblies to offset and form a diamond anchorage pattern throughout the subfloor.

C. Maple Flooring:

1. Install maple flooring parallel to main playing court by power nailing or stapling at all sleeper locations. End joints shall be properly driven up.
2. If required, size joints between flooring strips to allow for intermediate expansion in accordance with local humidity conditions.
3. Provided 1-1/2” expansion voids at perimeter and at all vertical obstructions.

3.4 FLOOR SANDING

A. Machine sand with coarse, medium and fine paper to a smooth, even and uniform surface.

B. Remove sanding dust from entire surface by tack of vacuum.

C. Refer to MFMA sanding and finishing guide for procedures.

3.5 FINISHING

A. Inspect entire area of floor to insure that surface is acceptable for finishing, completely free from sanding dust and perfectly clean.

B. Apply two (2) coats of approved seal and finish per finish manufacturer’s instructions.

C. Buff and clean floor between each coat or as necessary.

D. Paint game lines as shown on drawings, between seal coats. School logo shall be painted in the center of the court.

E. Game line paint shall be compatible with finish, as recommended by manufacturer. Maximum of 6 colors shall be specified for the game lines.
   1. Provide one (1) main basketball and volleyball courts.
   2. Provide two (2) secondary basketball and volleyball practice courts.

3.6 BASE INSTALLATION

A. Install Vent Cove base, pre-molded outside corners and mitering inside corners and anchoring to walls with base cement and screws and anchors.

3.7 MAINTENANCE

A. Upon completion of floor installation, the installer shall provide instruction in the care and maintenance as outlined within the manufacturer’s Care and Maintenance Manual.

B. Cover flooring until Substantial Completion.

3.8 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 09 64 66

SECTION 09 65 13 - RESILIENT BASE AND 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. This section includes the performance criteria, materials, production, and erection of resilient base and accessories for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all resilient base and accessories as required by the this section, schedules, keynotes and drawings, including, but not limited to the following:

1. Resilient base.
2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. No extra material to be purchased for purpose of attic stock. All left over material from construction to constitute attic stock – store, maintain and protect accordingly. Package with protective covering for storage and identified with labels describing contents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

2.2 THERMOPLASTIC-RUBBER BASE

A. Basis of Design: Subject to compliance with requirements, provide AllState Flooring Covebase Wall Base comparable products by one of the following:

1. Johnsonsite A Tarket Company
2. Armstrong World Industries, Inc.
3. Burke Mercer Flooring Products, Division of Burke Industries Inc.
4. Flexco.
5. Mondo Rubber International, Inc.
6. Nora Systems, Inc.
7. Roppe Corporation, USA.
8. VPI, LLC, Floor Products Division.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:
   a. Style: Cove:

1) Profile: As selected by Architect.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4.25 inches (108 mm) at carpet, 4 inches (102 mm) at all other areas.

E. Lengths: Length shall not be less than 1/3 of the length of a wall but not less than 3'-0 whichever is longer.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As indicated in the drawing.

2.3 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AllState Flooring
2. Johnsonsite A Tarket Company
3. Roppe Corporation, USA.
4. VPI, LLC, Floor Products Division.

B. Description: Rubber cap for cove carpet; cap for cove resilient flooring; carpet bar for tackless installations; carpet edge for glue-down applications; nosing for carpet; nosing for resilient flooring; reducer strip for resilient flooring; joiner for tile and carpet; transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT FLOORING

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 performance criteria, materials, production, and erection of resilient tile flooring, resilient sheet flooring and rubber stair treads for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all floor tile as required by the this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color and pattern of floor tile required.

C. Product Schedule: Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. No extra material to be purchased for purpose of attic stock. All left over material from construction to constitute attic stock – store, maintain and protect accordingly. Package with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
   2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

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

   1. Build mockups for flooring including resilient base and accessories.

      a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.

   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive floor tile during the following time periods:

   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 48 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

F. Do not install resilient flooring over concrete slabs until they are sufficiently cured and dry to achieve a bond with the adhesive in accordance with the manufacturer’s recommended bond and moisture tests.

PART 2 - PRODUCTS

2.1 RESILIENT SOLID VINYL FLOOR TILE

A. Basis of Design: Subject to compliance with requirements, provide the product indicated on drawings or comparable product to the following:
1. “Drawn Line 4.5MM” by Interface:
   a. Complies with requirements for ASTM F 1700, Class 1, Type A (Type B for slip resistant tile) Standard Specification for Solid Vinyl Floor Tile.
   b. Slip resistant tile with an embossed surface in designated areas
   c. Wear layer/Overall thickness: 1/8" (3.2 mm)
   d. Slip Resistance: ADA Compliant
   e. ASTM F 970, Standard Test Method for Static Load Limit – 800 PSI (modified for higher load)
   f. ASTM E 648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm^2 or greater, Class I
   g. Warranty: 10 year Manufacturer's Warranty
   h. Installation Method: Ashlar

B. Colors and Patterns: As indicated by manufacturer's designations and selected by Architect.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: As recommended by manufacturer to meet site conditions.
1. Solid Vinyl Tile, basis of design:
   a. Tarkett 800 Pressure Sensitive Adhesive
   b. Tarkett 940 Two-Part Polyurethane Adhesive
   c. Tarkett 120 SpraySmart Adhesive (up to 7 pounds moisture \ 85% relative humidity and less than 11 pH)

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

2.3 RUBBER STAIR TREADS/ LANDING TILE

A. Resilient rubber stair treads and landing tile, A.D.A. visually-impaired.

B. Basis of Design: Subject to compliance with requirements, provide the product indicated on drawings or comparable product to the following:
1. RTR-SQ & VIRTR-SQ by Johnsonite, Roundel Square Raised Disk pattern rubber stair treads with integrated riser:
   a. 2” hinged, square nose configuration, tapered 13” tread depth with 7” integral riser
   b. Matching rubber landing tile.
   c. Homogeneous composition of 100% synthetic rubber
   d. Meet performance requirements of ASTM F-2169, Type TS, Class 1 and 2, Group 1 and 2.
   e. Exceeds ASTM E648 Class 1 Flammability requirements.

2.4 RUBBER TILE FLOORING

A. Resilient rubber athletic flooring.

B. Basis of Design: Subject to compliance with requirements, provide the product indicated on drawings or comparable product to the following:
   1. **Johnsonite Replay®** -Tarkett North America, 30000 Aurora Road, Solon Ohio, 44139. Tarkett.com
      a. Material: Rubber Tiles
      b. Composition: recycled truck tire crumb rubber encapsulated in a urethane binder.
      c. Surface:
      d. Back of Tile:
      e. Tile Size: See drawings
      f. Thickness: 3/8”
      g. Color: See drawings.
   2. Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to manufacturer’s written instructions to ensure adhesion of resilient flooring.

   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Floor covering shall not be installed over expansion joints.

E. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RUBBER STAIR TREAD INSTALLATION

A. Comply with manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish, in areas specified: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. Cover floor tile until Substantial Completion.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 09 65 19

SECTION 09 67 23 – RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Provide a complete epoxy flooring system for concrete surfaces that meet the requirements for specific use indicated in the contract documents. Include all applicable substrate testing, surface preparation and detail work.

1.2 DEFINITIONS

A. Definitions: Resinous flooring includes penetrating, moisture tolerant, two-component epoxy primer, a high performance, three-component mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments, a two-component, general service epoxy coating and a selected, graded aggregate.

B. Related Work
   1. Division 3 Self Leveling Toppings
   2. Division 7 Section Joint Sealers

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.

B. Samples: Submit, for verification purposes, 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.
   1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity; Stonhard, Palma, or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

B. Pre-Installation Conference
   1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
   2. Attendance
      a. General Contractor
      b. Architect/Owner's Representative
      c. Manufacturer/Installer's Representative

C. ISO 9002: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9002 registered quality system.

1.6 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.

B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85°F/16 and 30°C.

1.7 PROJECT CONDITIONS

A. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade, or as indicated based on manufacturer’s requirements and slab moisture content. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

B. Utilities, including electric, water, heat (air temperature between 60 and 85°F/16 and 30°C) and finished lighting to be supplied by General Contractor.

C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor.

1.8 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation.

PART 2 - PRODUCTS

2.1 COLORS

A. Colors: Per Finish Schedule.

2.2 EPOXY FLOORING & BASE

A. Basis of Design: Hybri-Flex EC by Sherwin Williams Or Approved Equal

B. System Materials:
   a. Primer: PolyCrete TF, resin and hardener.
   b. First Broadcast Coat: Poly-Crete SL, resin and hardener.
      i. Chips: Dur-A-Flex, Inc. Macro Decorative Colored Chips.
   c. Second Broadcast: Resuflor Glaze Regular Hardener, Resuflor Glaze Resin

      ii. Chips: Deco Flake- Moon
   d. Grout coat: Resuflor Glaze Regular Hardener, Resuflor Glaze Resin
   e. Topcoat: Resutile AT hardener, Colorant, resin and grit.

C. PRODUCT REQUIREMENTS:

1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

A. Primer

1.	Percent Solids	56 %
2.	VOC	2 g/L
3.	Bond Strength to Concrete ASTM D 4541	550 psi, substrates fails
4.	Hardness, ASTM D 3363	3H
5.	Elongation, ASTM D 2370	9 %
6.	Flexibility (1/4: Cylindrical mandrel), ASTM D 1737	Pass
7.	Impact Resistance, MIL D-2794	>160
6.	Abrasion Resistance ASTM D 4060, CS 17 wheel, 1,000 g Load	30 mg loss

B. Broadcast Coat

1.	Percent Solids	100 %
2.	VOC	59 g/L
3.	Compressive Strength, ASTM D 695	16,000 psi
4.	Tensile Strength, ASTM D 638	3,800 psi
5.	Flexural Strength, ASTM D 790	4,000 psi
6.	Abrasion Resistance, ASTM D 4060 C-10 Wheel, 1,000 gm load, 1,000 cycles	35 mg loss
7.	Flame Spread/NFPA-101, ASTM E 84	Class A
8.	Impact Resistance MIL D-3134	0.025 inch Max
9.	Water Absorption. MIL D-3134	Pass
10.	Potlife @ 70 F	20-25 minutes

C. Broadcast Coat and Grout Coat

1.	Percent Solids	100 %
2.	VOC	3.8 g/L
3.	Compressive Strength, ASTM D 695	11,200 psi
4.	Tensile Strength, ASTM D 638	2,100 psi

5.	Flexural Strength, ASTM D 790	5,100 psi
6.	Abrasion Resistance, ASTM D 4060 C-10 Wheel, 1,000 gm load, 1,000 cycles	29 mg loss
7.	Flame Spread/NFPA-101, ASTM E 84	Class A
8.	Impact Resistance MIL D-24613	0.0007 inches, no cracking or delamination
9.	Water Absorption. MIL D-24613	Nil
10.	Potlife @ 70 F	20 minutes

D. Topcoat

1.	Percent Solids		95 %
2.	VOC		0 g/L
3.	Tensile Strength, ASTM D 2370		7,000 psi
4.	Adhesion, ASTM 4541		Substrate Failure
5.	Hardness, ASTM D 3363		4H
6.	60^0 Gloss ASTM D 523		70
7.	Abrasion Resistance, ASTM D4060	Gloss	Satin
	CS 17 wheel (1,000 g load) 1,000 cycles	4	8 mg loss with grit
		10	12 mg loss without grit
8.	Pot Life, 70 F, 50% RH		2 Hours
9.	Full Chemical Resistance		7 days

2. Other manufacturers as approved by Architect.

2.3 JOINT SEALANT MATERIALS

A. Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Substrate: Concrete preparation shall be by mechanical means and include use of a scabbler, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.2 APPLICATION

A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.

C. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using stainless steel finishing trowels.

D. Coating/Texture: Remove any surface imperfections by lightly abrading and vacuuming the floor surface. Mix coating and texture according to manufacturer's recommended procedures. Squeegee apply and backroll textured coating with strict adherence to manufacturer's installation procedures and coverage rates.

E. Patching: Patch as per manufacturer’s directions.

3.3 FIELD QUALITY CONTROL

A. The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.

B. The Owner will engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.

D. If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

3.5 WASTE MANAGEMENT

A. Coordinate with Division 01.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 09 67 23

SECTION 09 68 13 - TILE CARPETING

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 performance criteria, materials, production, and erection of carpet tile for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all carpet tile as required by the this section, schedules, keynotes and drawings, including, but not limited to the following:

1. Modular, tufted carpet tile.

B. Related Requirements:

1. Division 03: “Self-Leveling Toppings”

2. Division 09: "Resilient Base and Accessories", "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 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.

1.4 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.

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.

1.5 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.

1.6 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.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. No extra material to be purchased for purpose of attic stock. All left over material from construction to constitute attic stock – store, maintain and protect accordingly. Package with protective covering for storage and identified with labels describing contents.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

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

1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.10 FIELD CONDITIONS

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

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at 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.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. All carpet tile products to be Class A rated.

B. Basis-of-Design Product: Subject to compliance with requirements, provide:

1. Interface, “Open Air 403 Stria” Modular tile.
2. Color: As per schedule on drawings
3. Pattern:
4. Construction: Tufted
5. Surface Texture: Textured loop
6. Gauge: 1/12 (47.20 rows per 10 cm)
7. Dye Method: Solution Dyed
8. Fiber Type: Nylon
9. Backing System: ReadyBac
10. Size: 20 inches by 20 inches
11. Installation: Non Directional
12. Soil Release Technology
13. Performance Characteristics: Foot Traffic Recommendation TARR: Severe

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Metal Edge/Transition Strips: Extruded aluminum with satin finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. 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.
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 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

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. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," 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.

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.

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. Perform the following operations for existing carpet tile:
   1. Vacuum carpet tile using commercial machine with face-beater element.
   2. Remove stains and spots using cleaners as recommended by the carpet tile manufacturer.

C. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

D. 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.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 09 68 13

SECTION 09 77 20 – DECORATIVE FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished cementitious wallboard.

B. Products Not Furnished or Installed under This Section:
   1. Gypsum [Cementitious] substrate board.
   2. Resilient Base.

1.2 RELATED SECTIONS

A. Division 09 - Finishes

1.3 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. ASTM D 256 - Izod Impact Strengths (ft #/in)
   2. ASTM D 570 - Water Absorption (%)
   3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
   4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
   5. ASTM D 2583- Barcol Hardness
   6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.

2. For selected patterns show complete pattern repeat.
3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site (available as downloads for most Marlite's products at http://www.marlite.com/tech-details.aspx or by contacting Marlite at info@marlite.com).

1.5 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
a. Wall Required Rating – Class [A] [C].

B. Sanitary Standards: System components and finishes to comply with:
1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
3. Canadian Food Inspection Agency (CFIA) requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN MANUFACTURER

A. Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com.
   1. Standard FRP

B. Or Equal.

2.2 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
   1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
   2. Dimensions:
      a. Thickness – 0.090 “ (2.29mm) nominal
      b. Width - 4'-0” (1.22m) nominal
      c. Length – As indicated on the drawings
   3. Tolerance:
      a. Length and Width: +/-1/8 “ (3.175mm)
      b. Square - Not to exceed 1/8 “ for 8 foot (2.4m) panels or 5/32 “ (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
   1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
   2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
   3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
   4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
   5. Water Absorption - 0.72% per ASTM D 570.
   6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
   7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Front Finish: As Indicated on the Drawings
   a. Color: As chosen by Architect from full range of standard colors
   b. Surface: Standard FRP
   c. Fire Rating – Class A
   d. Size: As indicated on drawings

2.3 BASE

A. Base Molding for 0.090 “ (2.29mm) thick FRP Panels

2.4 MOLDINGS

A. Aluminum Trim: Heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory. (In Corridors)

B. PVC Trim: Thin-wall semi-rigid extruded PVC.(In Kitchens only)

C. SaniSeal Trim: Co-extruded, dual-durometer polypropylene/monprene profiles with Dual-Seal Technology and high-performance pressure sensitive adhesive.

D. Outside Corner Guard

2.5 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets, as recommended by panel manufacturer.
1. Match panel colors.
2. Length to suit project conditions.

B. Adhesive: As recommended by panel manufacturer

C. Sealant:
1. Clear Silicone Sealant, as recommended by panel manufacturer

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 foot (2.4m) of panel.
1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
2. Pre-drill fastener holes 1/8” (3mm) oversize with high speed drill bit.
a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
      b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
   1. All moldings must provide for a minimum 1/8 “ (3mm) of panel expansion at joints and edges, to insure proper installation.
   2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.3 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 09 77 20

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SECTION 09 84 33 - SOUND-ABSORBING WALL UNITS

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 shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:
   1. Custom fabricated acoustical wall panels.

1.3 REFERENCES

A. ASTM International
   1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

1.4 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.

B. Sustainable Submittals:

   1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data: For composite wood products used in sound-absorbing wall units, documentation indicating that product contains no urea formaldehyde.
   3. Laboratory Test Reports: For installation adhesives, composite wood products and sound-absorbing wall units, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For sound-absorbing wall and ceiling units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

D. Samples for Initial Selection: For each type of fabric facing from sound-absorbing wall unit manufacturer's full range.

E. Samples for Verification: For the following products, prepared on Samples of size indicated below:
1. Mounting Devices: Full-size Samples.
2. Assembled Panels: Minimum 6 inch x 6 inch samples of specified interior panels

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: 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. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by sound-absorbing wall units including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. Sprinklers.
f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to sound-absorbing wall units.

B. Product Certificates: For each type of sound-absorbing wall unit, from manufacturer.

A. Test Reports: Certified test reports showing compliance with specified performance requirements.
1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting

B. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.8 MAINTENANCE MATERIAL SUBMITTALS

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

1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards (9 m) quantity.
2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-absorbing wall and ceiling units from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 250 Maximum..

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 or NFPA 286.

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

1. Build mockup of typical wall area as directed by Architect. Include intersection of wall and ceiling, corners, and perimeters.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

D. Preinstallation Conference: Conduct conference at Project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install sound-absorbing wall units until a lighting level of not less than 80 fc (538 lux) minimum is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

E. Wall & Ceiling Conditions
1. The wall surface should be clean, dry, structurally sound, and free of mildew, grease, dust, or other stains.
2. Remove any existing wallcovering and adhesive.
3. Plaster and masonry wall surfaces should not exceed 5.5% moisture when measured by a BD-8 Delmhorst moisture meter. Gypsum board wall surfaces should not exceed 16% moisture.
4. Room humidity should not exceed 90%.
5. Wall surfaces should be primed with a quality wallcovering primer as approved by manufacturer. Wall surfaces with significant color variation should be primed with a good quality pigmented wallcovering primer.
6. New plaster should age 60-90 days before painting or installing wallcovering

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:

a. Defects in materials or factory workmanship

2. Warranty Period: Thirty (30) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

A. General Requirements for Sound-Absorbing Wall Units: Units shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Sound-Absorbing Wall Panel: Manufacturer's custom panel construction consisting of systems manufactured from domestic cementitious wood fiber

2.2 Manufacturer
A. Tectum® Direct-Attached Wall Panels:
1. Tectum® by Armstrong World Industries, Inc.
2. Or approved equal

2.3 TECTUM® DIRECT-ATTACHED WALL PANELS

A. Acoustical Panels Type AP-1:
   1. Surface Texture: Coarse
   2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
   3. Finish: Surface appearance shall be consistent from panel to panel
   4. Color: See drawings
   5. Size: Standard Custom Sizes (width 23 ¾" – 48"; length 12" – 144" – See drawings
   6. Thickness: (Standard 1")
   7. Edge Profile: (long edge/short edge – Bevel)
   8. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423 ; (Mounting; D-20(0.45) Classified with UL label.
   9. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criteria after being painted six times.
   10. Light Reflectance (LR) White Panel: ASTM E 1477;
   11. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
   12. Sustainable: Third party verified EPD (Environmental Product Declaration) and HPD (Health Product Declaration) and Living Product Imperative Certification.
   13. USDA Certified Biobased Product, 98%
   14. Attachment: 1x Furring strips 24" O.C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

A. Measure each wall area and establish layout of wall units. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
   1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent units.

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) wide.

3.5 ADJUSTING AND CLEANING

A. Replace damaged and broken Tectum® Direct-Attached Panels.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

3.6 WASTE MANAGEMENT

A. Coordinate with Division 01.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 09 84 33

SECTION 09 91 00 - PAINTING

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 performance criteria, materials, production, and erection of surface preparation and the application of paint systems for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all surface preparation and the application of paint systems as required by the this section, schedules, keynotes and drawings, including, but not limited to the following substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Cast iron.
5. Galvanized metal.
6. Aluminum (not anodized or otherwise coated).
7. Wood.
8. Gypsum board.
9. Plaster.
10. Spray-textured ceilings.
11. ASJ insulation covering.

B. Related Requirements:

1. Division 05 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.

1.3 DEFINITIONS

A. Gloss Level 1 G1 Matte or Flat Finish: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level G2 Velvet Finish: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level G3 Eggshell Finish: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level G4 Satin Finish: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level G5 Semi-Gloss Finish: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level G6 Gloss Finish: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level G7 High-Gloss Finish: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. 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.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. No extra material to be purchased for purpose of attic stock. All left over material from construction to constitute attic stock – store, maintain and protect accordingly. Package with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Akzo Nobel
2. Benjamin Moore & Co.
3. ICI Paints.
4. Kelly-Moore Paints.
5. Mastercoating technologies – Zolatone.
6. PPG Architectural Finishes, Inc.
7. Sherwin-Williams Company (The)
8. Insl-X

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. 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.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors: As indicated in a finish schedule.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

1. Glidden Professional – Concrete Coatings Block Filler Interior / Exterior Primer.
2. Akzo Nobel.
3. Sherwin Williams – Preprite – Interior / Exterior Block filler.

2.4 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

1. Product by one of the approved manufacturers found in the MPI list.

B. Primer, Alkali Resistant, Water Based: MPI #3.

1. Product by one of the approved manufacturers found in the MPI list.

C. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

1. Product by one of the approved manufacturers found in the MPI list.

D. Primer, Latex, for Interior Wood: MPI #39.

1. Product by one of the approved manufacturers found in the MPI list.

E. Primer Sealer, Alkyd, Interior: MPI #45.

1. Product by one of the approved manufacturers found in the MPI list.

F. Primer Sealer, Alkyd, Interior: MPI #69 (Gymnasium Ceiling).

1. Product by one of the approved manufacturers found in the MPI list.

G. Primer, Bonding, Water Based: MPI #17.

1. Product by one of the approved manufacturers found in the MPI list.

H. Primer, Bonding, Solvent Based: MPI #69.

1. Product by one of the approved manufacturers found in the MPI list.

I. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based: MPI #107.

1. Product by one of the approved manufacturers found in the MPI list.

B. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.

1. Product by one of the approved manufacturers found in the MPI list.

C. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

1. Product by one of the approved manufacturers found in the MPI list.

D. Primer, Galvanized, Water Based: MPI #134.

1. Product by one of the approved manufacturers found in the MPI list.

E. Primer, Vinyl Wash: MPI #80.

1. Product by one of the approved manufacturers found in the MPI list.

F. Primer, Quick Dry, for Aluminum: MPI #95.

1. Product by one of the approved manufacturers found in the MPI list.

2.6 WATER-BASED PAINTS

A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.

1. Product by one of the approved manufacturers found in the MPI list.

B. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2): MPI #144.

1. Product by one of the approved manufacturers found in the MPI list.

C. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3): MPI #145.

1. Product by one of the approved manufacturers found in the MPI list.

D. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147.

1. Product by one of the approved manufacturers found in the MPI list.

E. Acrylic, Interior, Institutional Low Odor/VOC, Multicolor MPI # 112.

1. Product by one of the approved manufacturers found in the MPI list.

F. Light Industrial Coating, Exterior, Water Based, Semi-Gloss (Gloss Level 5): MPI #163.

1. Product by one of the approved manufacturers found in the MPI list.

2.7 SOLVENT-BASED PAINTS

A. Alkyd, Interior, (Gloss Level 3): MPI #51.

1. Product by one of the approved manufacturers found in the MPI list.

B. Alkyd, Interior, (Flat) Spray Applied Dry Fall : MPI #118 (Gymnasium Ceiling)

C. Alkyd, Interior, Semi-Gloss (Gloss Level 5): MPI #47.

1. Product by one of the approved manufacturers found in the MPI list.

D. Alkyd, Quick Dry, Semi-Gloss (Gloss Level 5): MPI #81.

1. Product by one of the approved manufacturers found in the MPI list.

2.8 DRY FOG/FALL COATINGS

A. Interior Alkyd Dry Fog/Fall: MPI #118.

1. Basis-of-Design Product: Coronado Paint; Superkote 5000Alkyd Dryfall 105-1/131-1 or equal.

2. VOC Content: E Range of E2.

2.9 FLOOR COATINGS

A. Sealer, Water Based, for Concrete Floors: MPI #99.

1. Product by one of the approved manufacturers found in the MPI list.

2.10 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

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. Aluminum Substrates: Remove loose surface oxidation.

I. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. 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.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. 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.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.
    h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

4. Do not paint in mechanical rooms except as noted in 3.3.E.1.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

B. Concrete Substrates, Traffic Surfaces:

1. Water-Based Clear Sealer System:

a. First coat: Sealer, solvent based, for concrete floors, MPI #99.
b. Topcoat: Sealer, solvent based, for concrete floors, MPI #104.

C. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

D. Steel Substrates:

1. Quick-Drying Enamel System:

a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
c. Topcoat: Alkyd, quick dry, semi-gloss (Gloss Level 5), MPI #81.

E. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

F. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

G. Wood Substrates: Including wood trim, architectural woodwork, doors, wood-based panel products.

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

H. Fiberglass and Plastic Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, bonding, water based, MPI #17.
b. Prime Coat: Primer, bonding, solvent based, MPI #69.
c. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

I. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

2. Institutional Low-Odor/VOC Acrylic System:

a. Prime Coat: SP203Stain Acrylic Drywall Primer, Master Coating Technologies.

b. Intermediate Coat: Acrylic Interior, Institutional Low Odor/VOC, Multi-color, Master Coating Technologies., #MPI #112.
c. Finish Coat: Acrylic Interior, Institutional Low Odor/VOC, Multi-color, Master Coating Technologies., #MPI #112.

J. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

3.7 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.

2. Set aside and protect materials suitable for reuse and/or remanufacturing.

3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 09 91 00

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

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. The work performed under this Section **(provided by Owner, Installed by Contractor)** includes the performance criteria, materials, production, and erection of visual display units for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all visual display units as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to the following:

1. Tackboards.
2. Visual display wall panels.

1.3 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes visual display wall panels and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of magnetic markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Show locations of special-purpose graphics for visual display surfaces.
3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:

1. Actual sections of porcelain-enamel face sheet, tackboard assembly, visual display wall covering.
2. Include accessory Samples to verify color selected.

D. Samples for Verification: For each type of visual display surface indicated.

1. One visual display board assembly, mock-up complete with porcelain – enamel face sheet, tackboard and trim mounted on substrate. Board may be incorporated into project upon acceptance of mock-up.

E. Product Schedule: For visual display surfaces. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

C. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of visual display board.

B. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

C. Surface-Burning Characteristics: Class B as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.

1. Build mockup of typical visual display boards as shown on Drawings. Include accessories.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces**,** including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings 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.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.10 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following]:

a. Claridge Products and Equipment, Inc.
b. PolyVision Corporation; a Steelcase company.
c. A-1 visual system.

2. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.

B. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

C. Hardboard: ANSI A135.4, tempered.

D. Fiberboard: ASTM C 208.

E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

2.2 TACKBOARD ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-1 Visual Systems.
2. Claridge Products and Equipment, Inc.
3. PolyVision Corporation; a Steelcase company.

B. Natural-Cork Tackboard: 1/4-inch- (6-mm-) thick, natural cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard backing.

2.3 VISUAL DISPLAY WALL PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-1 Visual Systems.
2. Claridge Products and Equipment, Inc.
3. PolyVision Corporation; a Steelcase company.
4. Tri-Best Visual Display Products.

B. Marker Wall Sheets: Fabricated from 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets fused to steel; for direct application to wall surface.

C. Marker Wall Panels: Fabricated from markerboard assembly indicated.

D. Joint Accessories: Manufacturer's standard, exposed trim at butt joints.

E. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific tack wall panels and substrate application, as recommended in writing by visual display surface manufacturer.

1. 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. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 "Painting" and recommended in writing by visual display surface manufacturer for intended substrate.

G. Face Trim: 5/8 clear anodized aluminum with mitered corners.

H. Mounting Clip: Manufacturers standard.

2.4 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
1. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.

D. Modular Visual Display Boards: Fabricated with integral panel clips attached to core material.

E. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

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

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 VISUAL DISPLAY SURFACE SCHEDULE

A. Visual Display Board, Markerboard or Tackboard: Factory assembled.

1. Visual Display: Glass white board assembly. Basis of Design: Claridge Glass

a. Color: White/Clear
b. Corners: Square.
c. Width: 4ft
d. Height: 4ft
e. Mounting: Wall- Invisible mount
f. Mounting Height: As indicated on Drawings.
g. Factory-Applied Aluminum Trim and Marker Rail: Manufacturer's standard with clear anodic finish.

2. Tackboard: Factory assembled – At Teacher Stations in Classrooms

a. Tack Surface: Natural-cork tackboard assembly.
b. Color: Tan.
c. Corners: Square.
d. Width: See schedule below
e. Height: See schedule below
f. Mounting: Wall.
g. Mounting Height: As indicated on Drawings.
h. Edges: Concealed by trim.
i. Factory-Applied Aluminum Trim & Marker Rail: Manufacturer's standard style, with clear anodic finish.

3. Display Track System (NOT USED)
a. Method of display is a flexible and interchangeable system that consists of lightweight presentation components suspended from a wall mounted, linear, horizontal track. Track has two levels to attach components. Track allows attached components to slide horizontally. Presentation components are capable of being lifted from the track and being relocated to allow for reconfiguration. Components must be capable of being installed on the track without the use of tools for installation, removal, and reconfiguration. The presentation components consist of a Monitor (N.I.C.) with dry erase markerboard on both sides. Install and locate components on track in accordance with manufacturer's written recommendations. Provide markerboards with a marker rail Markerboard surface accepts magnets. Dry erase markings are removable with a felt eraser or dry cloth without ghosting. Provide each unit with an eraser and four different color compatible dry erase markers.

4. Horizontal Sliding Units (NOT USED)
a. Provide horizontal sliding unit composed of a fixed back panel, sliding panels, an aluminum track assembly, map rail and marker rail. Provide unit with [2] tracks. The fixed back panel is [markerboard]. Provide unit with [2] markerboard sliding panels. Reinforce frame assembly at corners. Sliding panels are suspended from the top and slide over the aluminum track using molded nylon ball bearing rollers at the top of the track and nylon guide rollers at the bottom of the track to eliminate vibration and to provide quiet and smooth operation of the panels. Sliding panels have finger pulls at each end. Marker rail extends the full length of the horizontal sliding unit. Dry erase markings are removable with a felt eraser or dry cloth

without ghosting. Provide each unit with an eraser and four different color compatible dry erase markers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 8 inches (200 mm) o.c. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 10 11 00

SECTION 10 14 00 – INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes identifying devices.

1.2 SUBMITTALS

A. See Division 1 – General Requirements for submittal procedures.

B. Product Data: Manufacturer's printed literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit three samples of each type of sign, of size similar to that required for project, illustrating sign style, font and method of attachment.
   1. Selection Samples: Where colors are not specified, submit three sets of color selection charts or chips.
   2. Verification Samples: Submit samples showing colors selected

E Manufacturer's Installation Instructions: Submit installation template and attachment devices.

1.3 QUALIFICATIONS

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

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor and building.

C. Store adhesive attachment tape at ambient room temperatures.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 STAINLESS STEEL LETTERS

A. Provide stainless steel letters with text and locations as indicated on Drawings.
1. Finish: Brushed Stainless Steel
2. Letter Style: Century Gothic Upper Case
3. Mounting: Concealed Studs, with stainless steel spacers.
4. Lighting: LED Backlit

B. Manufacturers
1. Letters and Signs.com
2. The Southwell Co., San Antonio, TX 78291
3. Andco Industries Corp., Greensboro, NC 27410
4. Matthews International Corp., Pittsburgh, PA 15212
5. Signs and Decal Corp., Brooklyn, NY 11211

2.2 EXTERIOR WALL SIGNS (At Handicapped Entrances)

A. Access entrance symbol sign, Black duranodic aluminum frame. Insert size 9" x 9". Insert shall have a raised 4" accessibility symbol with the verbal description, “Entrance” using 1" Gill Sans upper case letters directly below and followed by Grade 2 braille.

2.3 INTERIOR SIGNS

A. Manufacturers: Basis of design product is ‘Graphic Blast’ by Best Sign Systems, Inc., 1202 N. OArk Avenue, Montrose, CO 81401-3172; 970-249-2378

Comparable Manufacturers:
1. Ark Ramos
2. Mohawk Sign Systems, Inc.
3. Seton Identification Products.
4. Substitutions: See Division 1 - General Requirements for submittal procedures.

2.4 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADAAG and ANSI/CC A117.1 and applicable building codes,

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, excluding corridors, lobbies and similar open areas.

2.5 GRAPHIC PROCESS

A. Tactile characters shall be raised the required 1/32" inches from sign face. Glue-on letters or etched backgrounds are not acceptable.

B. All text shall be accompanied by Grade 2 braille. Braille shall be separated ½" from the corresponding raised characters or symbols. Grade 2 braille translation to be provided by signage manufacturer.

C. All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

D. Plaque material shall be Special Purpose SP125 decorative thermosetting high pressure laminate. Material to be 1/8” thick laminate with a melamine resin surface and a phenolic resin core which provides resistance to abrasion, stains, alcohol, solvents, boiling water, and heat. The material shall be NEMA rated and have flammability and smoke values that meet the standards for flammability of interior materials.

E. Background color as selected by architect from manufacturer’s actual color samples.

2.6 STAIR & ELEVATOR FLOOR LEVEL SIGNS, STAIR AND ELEVATOR FLOOR IDENTIFYING SIGNS

A. Provide stair and elevator floor number signs, stair and elevator floor identifying signs, door signs for exit Stairs.

2.7 ACCESSIBILITY GUIDELINES FOR SIGNAGE

A. Room Identification Signs: Signs which designate permanent rooms or spaces shall comply with the following guidelines:
1. Raised Copy - Letters and numerals shall be raised 1/32" upper case, sans serif or simple serif typestyle.
2. Character Height - Raised characters shall be at least 5/8" high, but no higher than 2".
3. Symbols - Symbols shall be accompanied by the equivalent verbal description placed directly below the symbol. The border dimension of the symbol shall be 6" minimum in height.
4. Braille Tags - Grade 2 Braille shall be on all signs, as required.
5. Colors - The characters and backgrounds of all signs shall be of matte or other non-glare finish. Characters and symbols shall contrast with light characters on a dark background or dark characters on a light background. Colors to be as selected by the Architect from the manufacturer's standard colors.
6. Mounting - Signs shall be installed on the wall adjacent to the latch side of the door. If there is no space on the latch side of the door, including double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be so that the baseline of the tactile copy is located between 48” at the lowest point to 60” at the highest point. . Mounting location for such signage shall be so that a person may approach within three inches of signage without encountering protruding objects or standing within the swing of a door.

B. Directional and Information Signs: Signs which provide direction to, or information about functional spaces of the building shall comply with the same guidelines as those set for Room Identification Signs with the following additions and exceptions.

1. Character Proportion - Letters and numerals on sign shall have a width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10.
2. Character Height - Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case X. Lower case characters are permitted. Any signs that are suspended or projected overhead shall have characters at least three inches high and shall maintain a minimum clearance of 80 inches from finished floor.
3. Raised Copy - Directional and Informational signs are NOT required to use raised copy or braille tags.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting Work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Sign Locations:
1. Room and Door Signs: Locate on wall at latch side of door. The sign shall be mounted so that the baseline of the tactile copy shall be between 48" at the lowest point to 60" at the highest point above finished floor.
2. If no location is indicated, obtain Owner/s instructions.
3. Maximum Occupancy Signs posted in Assembly spaces in a conspicuous place near the main or exit access doorway.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

3.3 WASTE MANAGEMENT

A. Coordinate with Division 01

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.

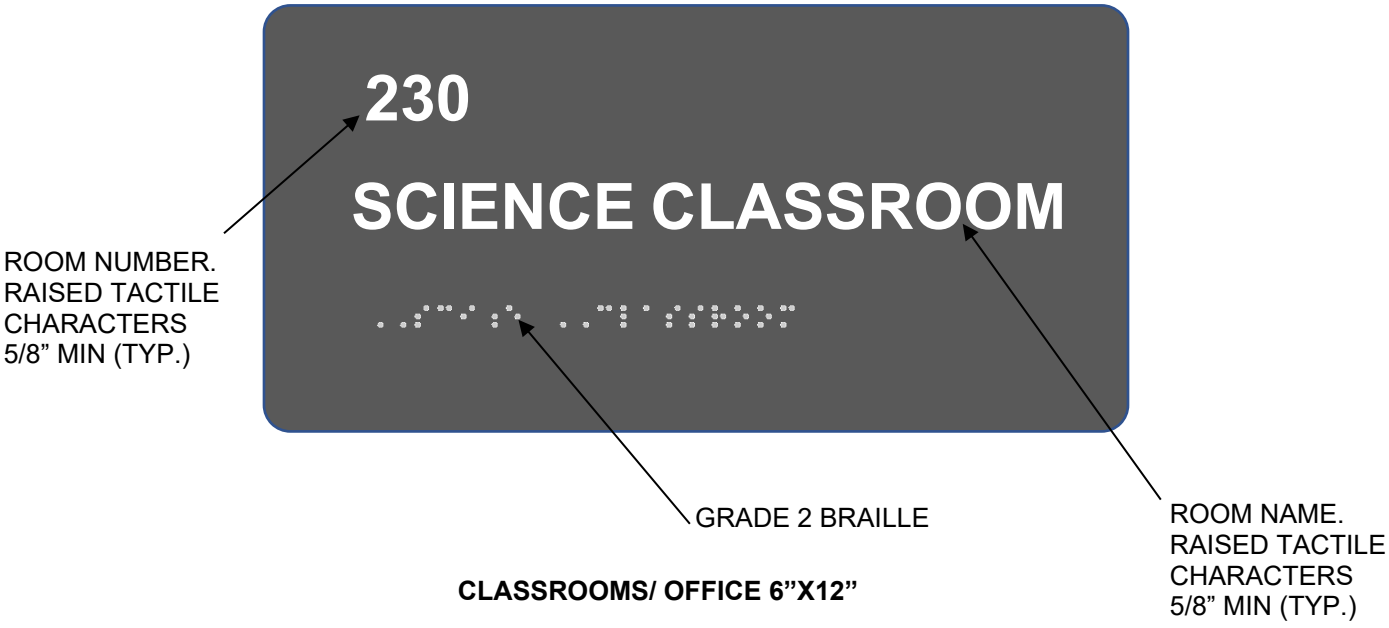
2. Set aside and protect materials suitable for reuse and/or remanufacturing.

3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

3.3 SIGN SCHEDULE:

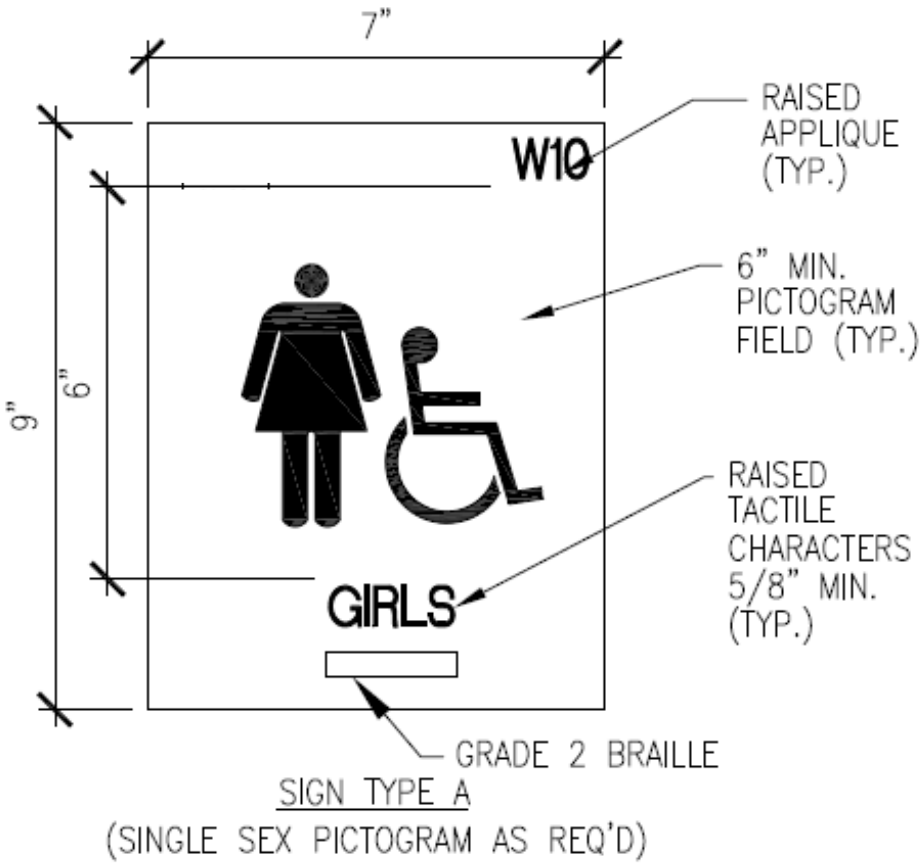
A. Provide one sign for every door in the door schedule. Including interior and exterior doors.

B. Required signage panels include, but may not be limited to the following:



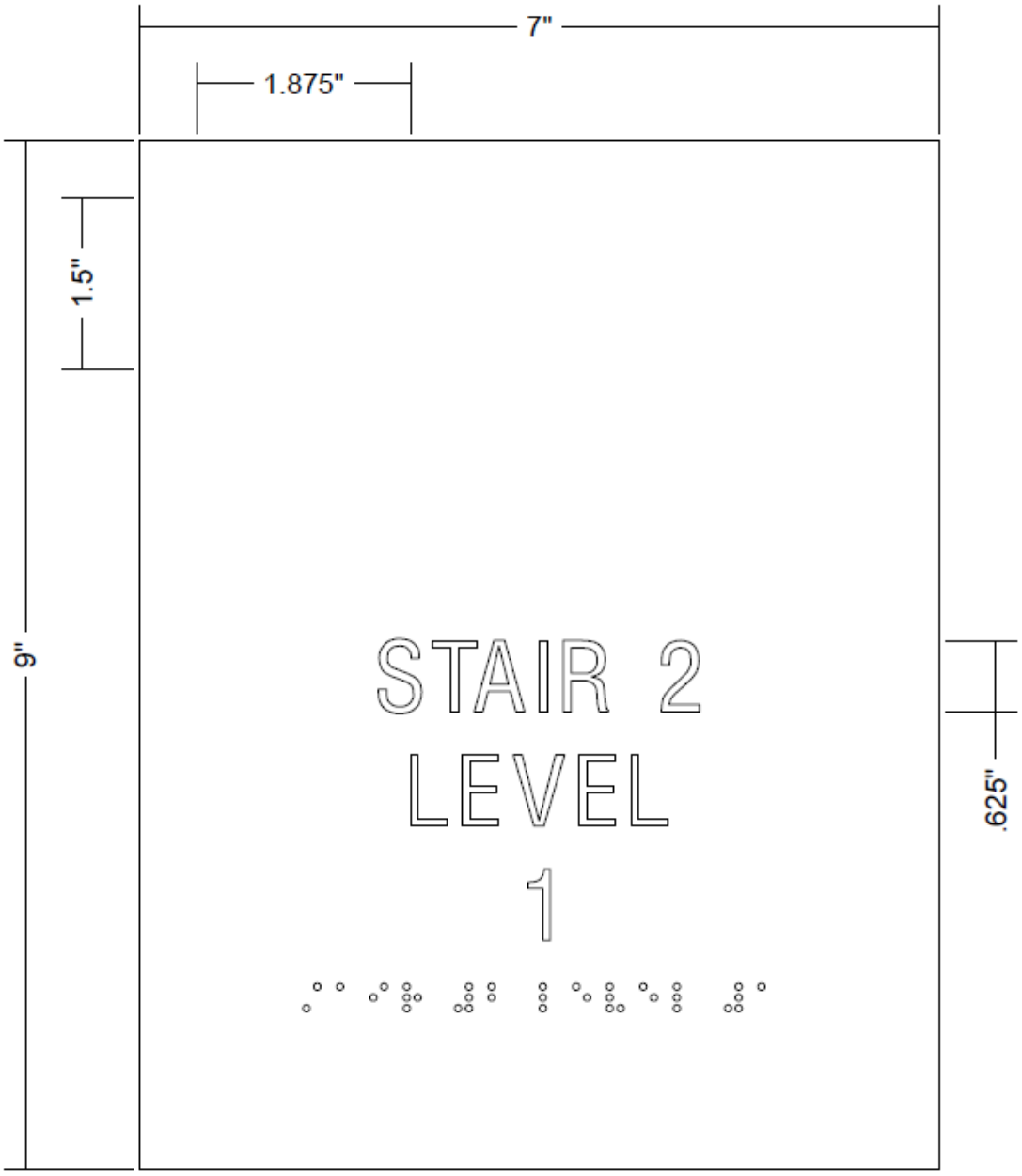
CLASSROOMS/ OFFICE 6”X12”

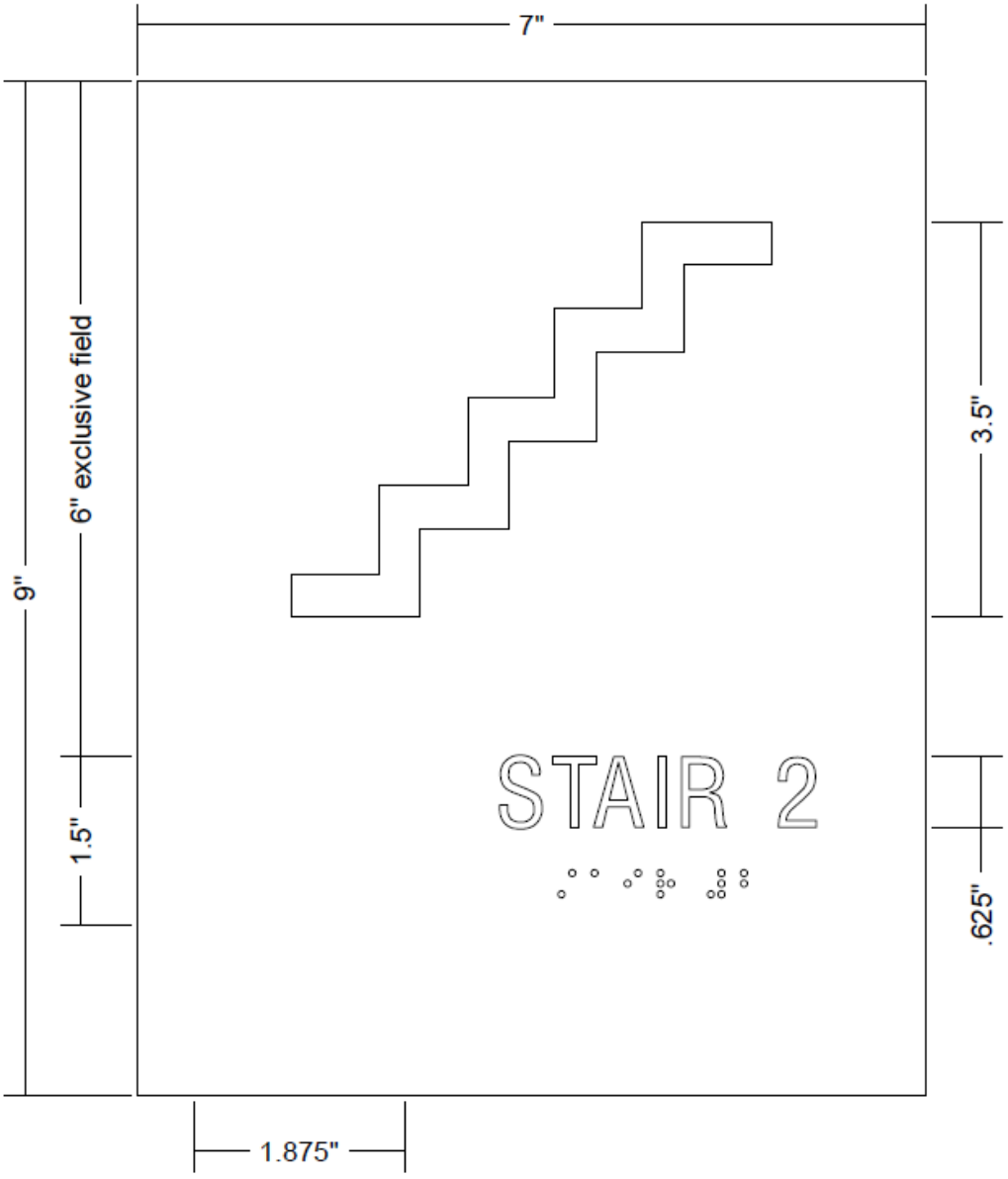
NTS

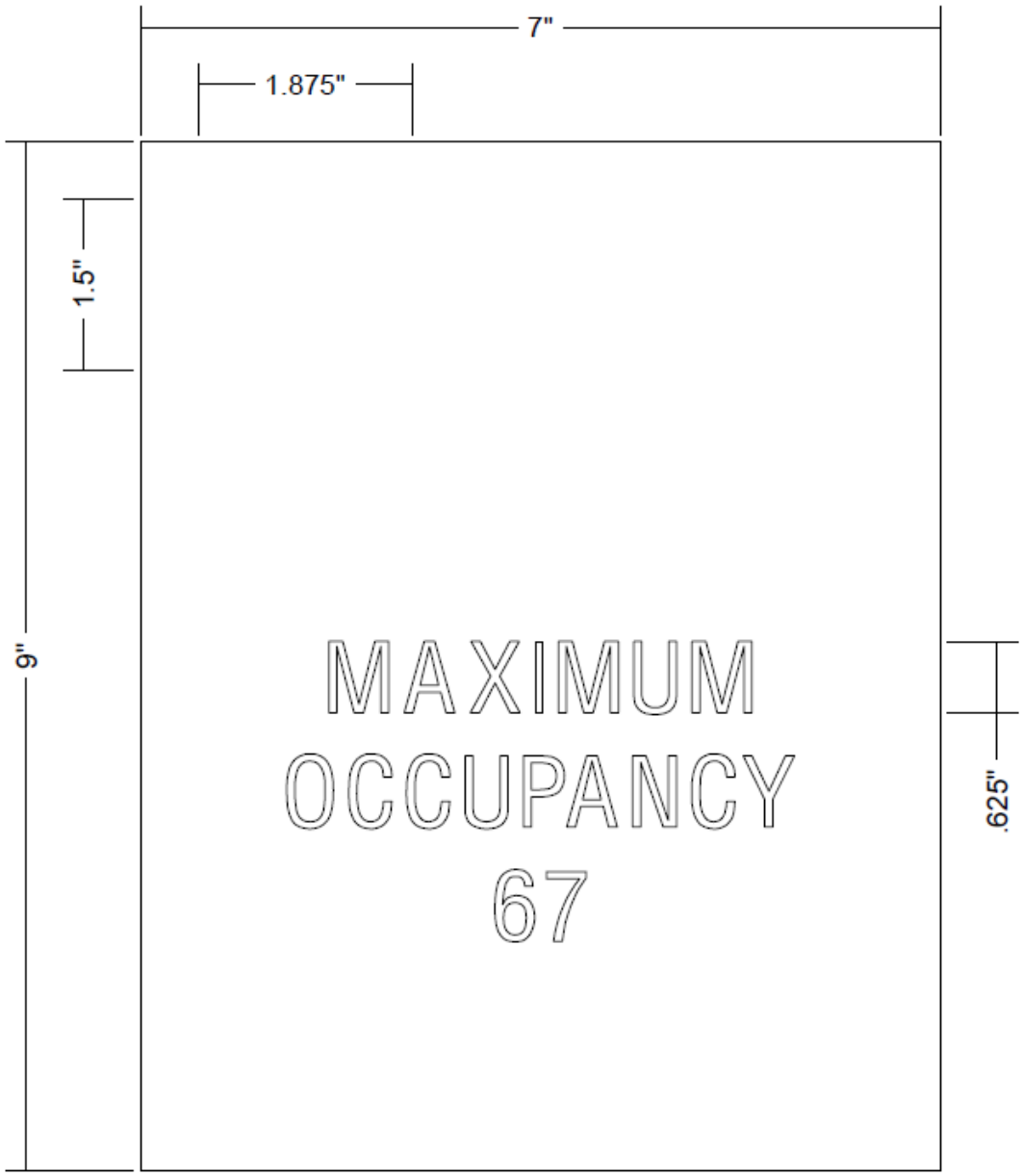


SIGN TYPE A
(SINGLE SEX PICTOGRAM AS REQ'D)

TOILET ROOMS
NTS


7"
1.875"
1.5"
9"
STAIR 2
LEVEL
1
.625"


7"
9"
6" exclusive field
1.5"
3.5"
.625"
1.875"
STAIR 2



END OF SECTION 10 14 00

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SECTION 10 19 00 - WALL AND DOOR 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:

1. Corner guards 2”w x 2”w x 48”h

B. Related Sections:

1. Section 05 50 00 "Metal Fabrications" for metal angle corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength**,** fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.

1. Include similar Samples of accent strips and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.

1. Corner Guards: 4” inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Material Certificates: For each impact-resistant plastic material, from manufacturer.

C. Material Test Reports: For each impact-resistant material.

D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

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. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- (1.2-m) long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.7 QUALITY ASSURANCE

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

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."

D. Revise subparagraph below to suit Project.

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. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

F. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

G. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards At high traffic areas: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. American Floor Products Co., Inc.
    b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    c. Korogard Wall Protection Systems; a division of RJF International Corporation.
    d. Pawling Corporation.
    e. WallGuard.com.

2. Material: Stainless steel, Type 304 Type 430.

    a. Thickness: Minimum 0.0625 inch (1.6 mm).
    b. Finish: Directional satin, No. 4.
3. Wing Size: Nominal 2 by 2 inches (65 by 65 mm).
4. Surface Mounted: guard to have factory-drilled mounting holes and counter sunk fasteners for CMU and metal stud walls.

B. Protection Plates: Fabricated from extruded rigid plastic, of thickness indicated.

2.3 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.4 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines, or blend into finish.
2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
3. Run grain of directional finishes with long dimension of each piece.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerance**,** fire rating**,** and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 21 00 - TOILET PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes toilet compartments and screens as follows:
   1. Type: Solid-plastic.
   2. Compartment Style: Overhead braced and floor anchored.

B. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for supports that attach units to overhead structural system.
   2. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.3 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 installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

D. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.4 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.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Scranton Products
   2. General Partitions Mfg. Corp.
   3. Bradley Corp.

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Solid-Plastic, Provide units with eased edges and with minimum 1-inch-thick doors and panels, and 1-1/4 inch pilasters. Provide units with Class B flame spread rating under ASTM E84, with smoke developed less than 450. Provide color as follows:
   1. Color: One color in each room as selected by Architect from manufacturer's full range of colors.

C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch thick and 3 inches high, finished to match hardware.

D. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:
   1. Material: Stainless steel.

E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

F. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

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.

B. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Doors: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments indicated to be handicapped accessible.
   1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
   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 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 between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ADJUSTING AND CLEANING

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.

3.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 10 21 00

SECTION 10 21 00 - EQUIPMENT SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum horizontal blade equipment screens.

1.02 RELATED SECTIONS *NOTE TO SPECIFIER* Delete sections not applicable.

A. Section 03 30 00 – Cast-In-Place Concrete

B. Section 04 20 00 – Unit Masonry

C. Section 05 10 00 – Structural Metal Framing

D. Section 06 10 00 – Rough Carpentry

E. Section 07 42 13 – Metal Wall Panels

F. Section 07 60 00 – Flashings and Sheet Metal

G. Section 07 92 00 – Joint Sealants

H. Section 09 91 00 – Painting

1.03 REFERENCES *NOTE TO SPECIFIER* Delete references not applicable.

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 – High Performance Organic Coatings on Architectural Extrusions and Panels.

C. AMCA 500-L – Test Methods for Louvers.

D. AMCA 511 – Certified Ratings Program for Air Control Devices.

E. ASCE 7 – Minimum Design Loads for Buildings and Other Structures

F. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B221 – Standard Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposure of Paint and Related Coatings.

I. ASTM D4214 – Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films.

J. ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

K. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00

B. Product Data: For each product to be used, including:

1. Manufacturer's product data including performance data.
2. Installation Instructions
3. Maintenance and Operations Manuals

C. Shop Drawings

1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

D. Samples

1. Submit color chip sample for units with factory-applied paint.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Manufacturer shall provide a standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the owner.

B. Manufacturer shall provide 20 year limited warranty for fluoropolymer-based finish on aluminum substrates.

1. Finish Coating shall not peel, blister, chip, crack, or check.
2. Chalking, fading, or erosion of finish when measured by the following tests:
   a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
   b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822
   c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.

PART 2 PRODUCTS

2.01 MANUFACTURER

1. Industrial Louvers Inc. (ILI) - Contact: 511 South 7th Street, Delano, MN 55328; Telephone: (763) 972-2981; Fax: (763) 972-2911.
2. Other Available Manufacturers – subject to compliance with requirements stated within.

2.02 EXTRUDED ALUMINUM HORIZONTAL BLADE EQUIPMENT SCREENS

A. Fabrication:

1. Model: 450XPI
2. Blades:
   a. Style: Horizontal
   b. Material: Extruded aluminum, 6063-T6
   c. Wall Thickness: 0.081 inch (2.1 mm), nominal
   d. Angle: 40 degrees
   e. Centers: 5 inches (127 mm), nominal
3. Supports: as required per wind load

2.03 FABRICATION

A. Fabrication Requirements:

1. Performance: Fabricate as required for optimum performance with respect to strength, durability, and appearance.
2. Size: Fabricate equipment screens to meet dimensions indicated on Contract Documents.
3. Field Measurement: Verify size, location, and placement of equipment screens before fabrication.
4. Shop Assembly:
   a. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
   b. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.
   c. Clearly mark units for reassemble and coordinated installation.
5. Accessories: Include supports, anchorages and accessories required for complete assembly.
6. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.
7. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.
8. Connections: Join frame and blade members to one another by mechanical fastener, except where field bolted connections between frame members are made necessary by size of louvers.
9. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.04 FINISHES (FACTORY)

A. General: Comply with NAAMM “Metal Finishes Manual” for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as indicated or, if not otherwise indicated, as selected by architect.

B. Standard mill finish.

C. Prime Coat:

1. Apply alkyd prime coat following chemical cleaning and pretreatment.
2. Primer preparation for field painting

D. Fluorocarbon Two Coat Coating

1. Coating shall conform to AAMA 2605.
2. Louvers to be finished with a minimum 1.0 mil (0.025 mm) thick full strength 70% resin, 2 coat Fluoropolymer system.
3. All aluminum shall be thoroughly cleaned, etched, and given a chromatic conversion pretreatment before application of coating.

E. Fluorocarbon Three Coat Coating

1. Coating shall conform to AAMA 2605.
2. Louvers to be finished with a minimum 1.4 mil (0.035 mm) thick full strength 70% resin, 3 coat Fluoropolymer system.
3. All aluminum shall be thoroughly cleaned, etched, and given a chromatic conversion pretreatment before application of coating.

F. Clear Anodize

1. Class I Clear Anodize
   a. Comply with Aluminum Association AA-C22A41. Clear anodized finish 215-R1.
   b. Apply finish following chemical etching and pretreatment
   c. Minimum thickness: 0.7 mils (0.018 mm).
2. Class II Clear Anodize
   a. Comply with Aluminum Association AA-C22A31. Clear anodized finish 204-R1
   b. Apply finish following chemical etching and pretreatment
   c. Minimum thickness: 0.4 mils (0.01 mm)

G. Color Anodize

1. Class I Bronze Anodize
   a. Light, Medium, Dark, Champagne
   b. Comply with Aluminum Association AA-C2242 or AA-C2244.
   c. Apply finish following chemical etching and pretreatment
   d. Minimum thickness: 0.7 mils (0.018mm).
2. Class I Black Anodize
   a. Comply with Aluminum Association AA-C2242 or AA-C2244.
   b. Apply finish following chemical etching and pretreatment
   c. Minimum thickness: 0.7 mils (0.018mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean opening thoroughly prior to installation

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install equipment screens at locations as indicated on the drawings and in accordance with the manufacturer's instructions.

B. Install equipment screens plumb, level and in alignment with adjacent work.

C. Install joint sealants as specified in Section 07 90 00.

3.04 CLEANING

A. Clean equipment screen surface in accordance with manufacturer's instructions.

B. Touch-up paint, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 21 00

SECTION 10 28 00 – TOILET AND BATH 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. The work performed under this Section includes the performance criteria, materials, production, and erection of toilet, bath and laundry accessories for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all toilet, bath and laundry accessories as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to the following:

1. Toilet room accessories.
2. Under-lavatory guards.
3. Custodial accessories.

B. Related Sections:
1. Division 09 "Ceramic Tile"

1.3 ACTION 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. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

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.

1.7 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.

1.8 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. 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.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 TOILET/ SHOWER ROOM ACCESSORIES – See Accessory Schedule on drawings

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. American Specialties, Inc.
2. A&J Washroom Accessories, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. Delta
6. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
7. Tubular Specialties Manufacturing, Inc.

2.3 UNDER-LAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

B. Under-lavatory Guard:

1. Basis-of-Design Product: ISP Corp Truebro Lav Guard 2.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 WASTE MANAGEMENT

A. Coordinate with Division 01.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

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. The work performed under this Section includes the performance criteria, materials, production, and erection of Fire Extinguisher Cabinets for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all Fire Extinguisher Cabinets as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction.

B. Related Sections:

1. Division 10: "Fire Extinguishers."

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

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

D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

D. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:
   a. Schedules and coordination requirements.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.7 SEQUENCING

A. Apply decals or vinyl lettering on field painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209 (ASTM B 209M).

2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher, FEC and hose, rack, valve, and extinguisher, FAC.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fire End & Croker Corporation.

b. J. L. Industries, Inc., a division of Activar Construction Products Group.
c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
d. Larsen's Manufacturing Company.
e. Modern Metal Products, Division of Technico Inc.
f. Moon-American.
g. Potter Roemer LLC.
h. Watrous Division, American Specialties, Inc.

B. Cabinet Construction: Where cabinets are located if fire rated walls, provide “Fire-FX” option for cabinet construction.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Steel sheet.

D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch (64-mm) and 4-inch (102-mm).backbend depth. Coordinate with wall thicknesses.

F. Surface Mounted Cabinet: Cabinet box surface mounted on walls.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

G. Cabinet Trim Material: Same material and finish as door.

H. Door Material: Steel sheet.

I. Door Style: Fully glazed vertical panel with frame.

J. Door Glazing: Tempered break glass.

K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

L. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.

3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
   a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
      1) Location: Applied to cabinet glazing.
      2) Application Process: Silk-screened.
      3) Lettering Color: White.
      4) Orientation: Vertical and Horizontal per location.

M. Finishes:

1. Manufacturer's standard baked-enamel paint or powder coat for the following:
   a. Exterior of cabinet door, and trim, except for those surfaces indicated to receive another finish.
   b. Interior of cabinet and door.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.

B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply decals at locations indicated.

E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.2 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 10 44 13

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SECTION 10 44 16 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Division 10 "Fire Extinguisher Cabinets."

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.7 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Guardian Fire Equipment, Inc.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Larsens Manufacturing Company.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

C. Multi-Purpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10 lb. nominal capacity, in enameled steel container, for Class A, Class B and Class C fires.

a. Provide multi-purpose dry chemical type ABC extinguishers except where otherwise noted.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Guardian Fire Equipment, Inc.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Larsens Manufacturing Company.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 10 44 16

SECTION 10 51 13 - METAL LOCKERS AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Standard lockers – fully welded assembly. Knock down lockers are not accepted.

B. Accessories including, tops, bases, vertical fillers, recess trim, and pad locks provided by manufacturer.

C. Locker Room benches attached to floor, including ADA compliant benches

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Furring, blocking, and shims.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) A 366/A 366M - Standard Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.

B. ADAAG - American with Disabilities Act, Accessibility Guidelines.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Provide layout and elevations of lockers with overall dimensions.

D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms.

E. Selection Samples: For finish product specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product and color selected.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Sequence deliveries to avoid project delays, but minimize on-site storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. ASI Storage Solutions, Inc.
   2. DeBourgh Manufacturing Co.
   3. Penco Products, Inc.

B. Requests for substitutions: Full size samples of each locker type and a written side by side comparison to the specified product will be required 7 days prior to bid opening.

C. Provide all metal lockers from a single manufacturer.

2.2 MATERIALS

A. Steel: Prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a high-grade enamel finish.

B. Hooks: Zinc plated forged steel, ball ends.

C. Rivets, Bolts and Nuts: Not Accepted.

2.3 STANDARD LOCKERS

A. Design Basis – ASI Traditional Plus Collection.

B. Locker Configurations:
   1. Single Tier: 78 inches
   2. Double Tier: 78 inches
   3. Triple Tier: 78 inches

C. Material: Mild cold rolled commercial quality steel, ASTM A1008.

D. Finish: Steel surfaces power washed, phosphate treated, and finished with an electrostatically applied 2-mil thick hybrid epoxy/polyester powder coating and baked.

E. Construction: Unitized with common intermediate uprights separating units.

F. Door Frames:
   1. 16-gauge channel
   2. Vertical members shall have additional flange to provide a continuous door strike.
   3. Cross frame members: 16-gage channel shaped
      a. Double Tier Lockers: Include intermediate cross frames.
      b. Triple Tier Lockers: Include intermediate cross frames.

G. Doors:
   1. 14-gage channel shaped on both the lock and hinge side, with angle formations across the top and bottom.
   2. 16-gage full height reinforcement channel on Single, Double, and Triple Tier lockers.

H. Body:
1. Bottoms: 16-gage.
2. Tops, Sides, Backs and Shelves: 16-gage.
3. Welded construction. Rivets, Bolts and Nuts are not accepted.

I. Hinges: 16-gage continuous piano type, riveted to both door and frame.

J. Handles: One-piece 20-gage deep drawn stainless steel cup designed to accommodate locks.

K. Latching:
1. 11-gage frame hook secured to the fame.
2. Padlock hasp protruding through recessed handle.
3. Provide rubber silencer secured to frame at each latch hook.

L. Interior Equipment:
1. Shelf at single tier lockers 48 inches or higher.
2. 3 wall hooks and one ceiling hook at single tier lockers less than 18 inches deep.
3. Coat rod instead of a ceiling hook at single tier lockers 18 inches deep or more.
4. 3 wall hooks and one ceiling hook Double Tier lockers
5. 3 wall hooks at 12 inch wide triple tier lockers.
6. 4 wall hooks at 15 inches and wider triple tier lockers.

M. Number Plates: Polished aluminum number plate riveted to door face with black numerals 1/2 inch high.

N. Color:
1. Doors and exposed body parts as selected from ASI's standard designer color range.
2. Non-exposed body parts finished as selected by Architect.

O. Closed Base:
1. Provide 4 inch high, 14 gauge welded steel base enclosed on all four sides, securely welded to locker bottom.

2.4 ACCESSORIES

A. Fillers-Vertical: Fillers shall be 20 guage sheet steel, powder coated to match the color of the lockers.
1. Filler width: 6 inches (152 mm).
2. Filler Width: 12 inches (305 mm).

B. Recess Trim: Recess trim shall be 18 gauge sheet steel, powder coated to match the color of the lockers.
1. Left Hand Side Trim:
   a. 3 inches (76 mm) wide by 63 inches (1.60 m) high.
   b. 3 inches (76 mm) wide by 75 inches (1.90 m) high.
2. Right Hand Side Trim:
   a. 3 inches (76 mm) wide by 63 inches (1.60 m) high.
   b. 3 inches (76 mm) wide by 75 inches (1.90 m) high.
3. Top Trim: 74 inches (1.88 m) long by 3 inches (76 mm) high
4. Splice: 2 inches (50 mm) by 3 inches (76 mm).

C. Locks:

1 Combination Padlocks (at all lockers): Rust resistant combination padlocks shall be furnished with master keying. Locks shall be 3-number dialing.

2.5 BENCHES

A. Basis of Design: Robinson Steel Co., or approved equal.

B. Plastic benches
1. Phenolic tops are impact, water corrosion resistant and does not support bacteria.
2. 9 1/2” W x 48” L
3. 16-1/4"H 201 grade stainless steel pedestal is attached to the phenolic bench via an 8" round integrated plate and screws.
4. 1" thick black phenolic resin seat with 1/8" eased radius edge on all corners and sides
5. Pre-drilled seat to accept pedestal mounting hardware
6. Two pedestals,
7. Floor mounting hardware

C. ADA compliant plastic benches
1. Seat and backs made from 1.5" thick HDPE solid plastic with texture
2. 42” W x 20” D
3. Floor mounted pedestals are made from PVC in Steel gray
4. Back Support height is 20" and made from 1/4" thick steel in finish Sandcastle
5. Seat Height: 17 - 5/8" high
6. Approx overall height (floor to top of bench back): 36 1/2"
7. Will not delaminate, fade or splinter. Product is non-absorbing and mark resistant.
8. Mounting holes in top and bottom flanges of pedestals for secure mounting to the floor and bench tops
9. Pedestal hardware for attaching to the bench top included.
10. Floor mounting hardware included
11. Color as selected by Architect from manufacturer’s standard colors

2.6 ADA COMPLIANCE

A. 5% of the lockers installed in each program space shall be ADA compliant and integrated throughout program space. Handicapped accessible lockers shall be single tier or the lower opening of a double tier locker. Single Tier lockers shall have a shelf no higher than 48” off the floor, with an extra shelf added to bring the bottom of the locker to no lower than 15” above the floor. On Double Tier lockers, an extra shelf shall be added to bring the bottom of the locker to no lower than 15” above the floor. Doors assigned for handicapped use shall have an appropriate symbol sign. Lockers shall be supplied with an ADA compliant single touch latch. Only recessed handles meet ADA specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates and bases have been properly prepared.

B. If substrate and bases are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install metal lockers and accessories at locations shown in accordance with manufacturer's instructions.

B. Install lockers level and plumb with flush surfaces and rigid attachment to anchoring surfaces.

C. Anchor lockers to floor and wall at 48 inches (1.219 m) or less, as recommended by the manufacturer.

D. Bolt adjoining locker units together to provide rigid installation.

E. Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.

F. Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.

G. Install benches by fastening bench tops to pedestals and securely anchoring to the floor using appropriate anchors for the floor material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

B. Touch-up with factory-supplied paint and repair or replace damaged products before Substantial Completion.

3.4 PROTECTION

A. Protect installed products until completion of project.

3.5 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 10 51 13

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SECTION 10 53 00 -CANOPIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Freestanding, pre-engineered metal canopies including concrete foundation, steel framing, metal roof, roof drains and leaders, fascia components, and metal ceiling and accessories.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Concrete islands and curbing.

B. Section 079200 - Joint Sealers.

C. Division 25 – Facility Fueling Systems

D. Division 26 - Electrical: Electrical wiring and connections.

1.3 REFERENCES

A. American Institute of Steel Construction, Inc. (AISC): AISC 360 - Specification for Structural Steel Buildings (copyrighted by AISC, ANSI approved).

B. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures (copyrighted by ASCE, ANSI approved).

C. American Welding Society (AWS): AWS D1.1 - Structural Welding Code - Steel (copyrighted by AWS, ANSI approved).

D. ASTM International (ASTM):

1. ASTM A 36/A 36M - Standard Specification for Structural Steel.

E.National Association of Architectural Metal Manufacturers (NAAMM): NAAMM MFM - Metal Finishes Manual.

F. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide pre-engineered canopies capable of withstanding the effects of gravity, wind, seismic, thermal and other project specific load conditions as required by the current building code for the site-specific location where canopy is installed:

1. Uniform pressure as indicated on drawings – Minimum design loads per

ACSE 7.

2. OR Project Specific design requirements (to be provided by owner prior to canopy design).

B. Thermal Movements: Provide pre-engineered canopies 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 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.5 SUBMITTALS

A. General: Submit under provisions of Section 01300 - Submittal Procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Submit shop drawings. Include plans, elevations, sections, details, and attachments to other work. Canopy supplier shall furnish complete canopy drawings signed and sealed by a professional engineer licensed in the state where the canopy shall be installed.

D. Samples:

1. Submit samples for initial color selection. Submit samples of each specified finish. Submit samples in form of manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full, range of variations expected.

E. Certificates: Submit product certificates signed by the manufacturer certifying material compliance with specified performance characteristics and criteria, and physical requirements.

F. Warranty Data: Submit warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in engineering and manufacturing pre-engineered canopies with a minimum documented experience of twenty years and with an in-house quality inspection program not by AISC or other certification program

B. Welding: Qualify procedures and personnel according to the following:

1. Welding shall be in accordance with AWS D1.1 (with E70XX electrodes).
2. Steel shop connections shall be welded and field connections shall be bolted

(unless otherwise noted on the Drawings). Shop welds may be changed to field welds with the approval of the project engineer.

3. Slag shall be cleaned from welds and inspected. Steel shall be painted with red oxide rust-inhibitive primer (unless galvanizing specified).

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Source Limitations: Obtain pre-engineered metal canopy through one source from a single manufacturer who shall manufacture and install the canopy.

E. Product Options:

1. Information on the Drawings and in the Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance. Do not modify intended aesthetic effects, as judged solely by the Architect, except with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.
2. The Drawings indicate size, profiles, and dimensional requirements of pre-engineered metal canopies and are based on the specific system indicated. Refer to Refer to Section 01600 - Product Requirements. Do not modify intended aesthetic effects, as judged solely by the Architect, except with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.

F. Coordination:

1. The Contractor shall conduct site meetings to verify project requirements, substrate conditions, utility connections, manufacturer's drawings and installation instructions. Comply with Division 1 section on project meetings.
2. The contractor shall prepare for and pour the concrete footers for the pre-engineered metal canopies. Manufacturer shall furnish recommended footing drawings as per IBC Section 1807.3 and prints and rebar details for concrete footings, as well as provide anchor bolts to be embedded in concrete footer. Such items shall be delivered to project site in time for installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect components and accessories from corrosion, deformation, damage, and deterioration when stored at job site. Keep materials free from dirt and foreign matter.

1.8 PROJECT CONDITIONS

A. Field Measurements: The Contractor shall verify location and elevation of footings relative to finished grade, columns, and other construction contiguous with pre-

engineered metal canopies by field measurements before fabrication and indicate measurements on shop drawings.

1. Established Dimensions: The Contractor shall, where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal canopies without field measurements. Contractor is responsible to coordinate footer locations and elevations with any interferences with or attachments to abutting structures.

1.9 WARRANTY

A. Austin Mohawk warrantees the products it manufactures to be free of defects in materials, leaks, and workmanship for 1 year from date of shipment.

1. Austin Mohawk also offers a 20-year limited warrantee against peeling, flaking, chipping of canopy deck when properly maintained, and pass on manufacturer's warrantees for accessory items, replacement of materials only no labor coverage per vendor warranty coverages

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Austin Mohawk and Company, Inc., which is located at: 2l75 Beechgrove Place ; Utica, NY 135O1; Toll Free Tel: 8O0-765-3l10; Tel: 3l5- 793-3O00; Email: request info (info@austinmohawk.com); Web: www.austinmohawk.com

B. Substitutions: Not permitted.

C. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01600 - Product Requirements.

2.2 MATERIALS

A. Structural Steel:

1. Material and work shall conform to the latest AISC 360.
2. Structural steel shall be painted with a rust inhibitive (red oxide) primer (std). OR
3. Structural steel shall be hot-dip-galvanized.

B. Sheet Metal:

1. Decking: 3 inch (76 mm) by 16 inch (406 mm) by 20 gage smooth white or embossed available, ASTM A 653/A 653M GR40, Fy = 40 ksi, galvanized steel with baked enamel finish.
2. Center and Tapered Gutter: 20 gage hot-dip galvanized steel baked enamel finish.
3. Perimeter Gutter: 20 gage hot-dip galvanized steel baked enamel finish.
4. Internal Downspout: 3 inch (76 mm) diameter PVC
   OR
5. External Downspouts: 3 inch (76 mm) by 4 inch (102 mm) Aluminum in 10’

sections

2.3 PRE-ENGINEERED METAL CANOPY

A.General: Provide a complete, integrated set of manufacturer's standard design canopy components to form a pre-engineered canopy ready for installation on project site. Canopy steel framing consists of using stacked wide-flange roof beams which transfer loads to columns. Columns are designed as fixed base elements to transfer vertical & lateral loads and moments to concrete foundations. Columns are typically located in an area of site protected from drive lane traffic. Pre-engineered metal canopy shall be designed to meet all site specific design loads per Section

1.4.A or project specific requirements.

B. Canopy Fascia:

1. Aluminum Composite Panel (ACM): Available with a fluorocarbon paint finish, masked on one side. Shall be warranted for 5 -10 years depending on color and finish selection.
2. Standing Seam Steel MPN120 panels in 24 ga standard colors 70% PVDF resin-based coatings provide high performance durability for exterior and interior applications. These coatings are designed to resist fading, chalking and abrasion. Meets the requirement of AAMA 2605-13 for aluminum substrates
3. Fascia: Various custom fascia to meet design requirements such as architectural shingle, EIFS, standing seam panels.

C. Canopy Finishes: Comply with NAAMM MFM for recommendations for applying and designating finishes.

1. 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.

D. Fabrication: Fabricate pre-engineered canopies completely in factory.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

1. Examine supporting foundations for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of supporting members.
2. Verify the rough-in of required mechanical and electrical services prior to placement of the structure.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A.A work area shall be required extending 10 feet (3 m) beyond buildings and canopies in all directions to the extent practical. The work area shall be flat, comprised of hard-packed soil or gravel, asphalt, or concrete, and free of open excavation, debris, construction equipment and construction workers. An additional flat work space a minimum of 25 feet (7.6 m) by 25 feet (7.6 m) or as practical shall be provided adjacent to the canopy and/or building for unloading and storing materials. Site to meet OSHA guidelines to allow lift equipment and scaffolding to maneuver the work area.

B. Set pre-engineered metal canopy plumb and aligned. Level base plates true to plane with full bearing on concrete bases.

C. Fasten pre-engineered metal canopy columns to anchor bolts and/or foundation bolts.

D. Provide anchor bolts as follows:

1. Anchor bolts or foundation bolts will be set by the Owner in accordance with approved site-specific drawings. They must not vary from the size and dimensions shown on the erection drawings. Use of a plywood template is recommended. Remove template prior to column erection.
2. Anchor bolts shall conform to ASTM F1554 grade 55 and shall have a minimum of 7 inches (178 mm) of exposed thread and 23 inch (584 mm) minimum embedment with 1-1/4 inch (32 mm) nut and washer as embedment end.

E. Provide bolted connections as follows:

1. Structural erection bolts shall conform to ASTM A 325/A 325M.
2. Bolts shall be tightened to snug tight per latest RCSC specifications (unless otherwise specified).

F. Provide screws as follows:

1. Fastening shall be performed per installation prints provided by the manufacturer.
2. Self-drilling and self-tapping screws shall have a sufficient cut point and a 1/2 inch (13 mm) outside diameter dished metal-backed neoprene washer to be used in water sealing applications.

G. Provide pedestrian protection and warnings during construction which comply with local, Federal, and OSHA codes.

H. Prior to steel erection of any kind, the Contractor shall grade, backfill and otherwise prepare the job site to allow for rolling scaffold and ensure safe working conditions including the removal or relocation of overhead power lines.

I. Any grade or elevation situations which deviate from the approved manufacturer's plans

shall be conveyed to the manufacturer prior to fabrication.

J. All anchor bolts and/or leveling plates shall be set within 1/4-inch (6 mm) tolerance on layout and grade level.

K. Temporary electrical power shall be provided.

L. Connect electrical power service to power distribution system according to requirements specified in Division 16 - Electrical.

M. Dumpster for trash and debris shall be provided by the Contractor.

3.4 ADJUSTING AND CLEANING

A. After completing installation, inspect exposed finishes and repair damaged finishes.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 10 53 00

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SECTION 11 31 00 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigeration appliances
   2. Cleaning appliances

1.2 ACTION SUBMITTALS

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

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

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Provide electric-operated appliances with manufacturer's conversion kit installed by a qualified service agency according to manufacturer's written instructions for Project location and type of fuel.

C. Pre-installation Conference: at project site.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, acceptable manufacturers, but not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
1. Asko.
2. KitchenAid
3. General Electric
4. Lab Rep Co.
5. Summit Appliances
6. Frigidaire

2.2 REFRIGERATOR/FREEZERS

A. Compact Refrigerator:

1. Basis-of-Design Product: Summit Appliance – All Refrigerator -ADA Complaint (Model # AL54CSSTB)
2. Type: Free Standing
3. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
4. Front Panel: Stainless Steel.

B. Full Size Refrigerator:

1. Basis-of-Design Product: Whirlpool-Top Freezer Refrigerator -ADA Complaint (Model # WRT519SZD)
2. Type: Free Standing
3. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
4. Front Panel: Stainless Steel.

2.3 ICEMAKERS

A. Icemaker:

1. Basis-of-Design Product: Summit Appliance BIM 44ADA.
2. Type: Built-In.
3. Ice Capacity:

a. Production: 40 lbs per day.
b. Storage: 25 lb.

4. Features:

   a. Automatic defrost.
   b. Automatic shutoff.

5. Front Panel: Stainless Steel.

2.4 DISHWASHERS

A. Dishwasher: Complying with AHAM DW-1 and ASSE 1006.

1. Basis-of-Design Product: GE (Model #GDT665SSN).
2. Type: Built-in undercounter.
3. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
4. Front Panel: Stainless Steel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

D. Utilities: Comply with plumbing and electrical requirements.

3.2 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 visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. Prepare test and inspection reports.

3.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23
   1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
   2. Set aside and protect materials suitable for reuse and/or remanufacturing.
   3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 11 31 00

SECTION 11 40 00 – FOOD SERVICE EQUIPMENT

PART 1 – GENERAL SPECIFICATIONS

1.01 GENERAL CONDITIONS:

A. DEFINITIONS:

The following definitions are intended to clarify the relationships involved in this Contract and are used as defined throughout this specification.

1. FOOD SERVICE EQUIPMENT CONTRACTOR (F.S.E.C.) (Who may alternately be referred to as the Kitchen Equipment Contractor (K.E.C.) in this document and on the Food Service Design Drawings.)

2. SUB-CONTRACTORS: The F.S.E.C. may contract SUB-CONTRACTORS to perform any portion of this contract, but final responsibility for the proper performance of this contract rests with the F.S.E.C.

3. GENERAL CONTRACTOR (G.C.): The G.C. or CONSTRUCTION MANAGER (C.M.) has the responsibility for overall installation, scheduling, deliveries, coordination of various trades, and rough-in and connection of utilities for equipment in this Contract. The F.S.E.C. must closely coordinate their activities and needs with the General Contractor and/or Construction Manager.

4. ARCHITECT: The ARCHITECT is the OWNER'S representative for the proper performance of all elements of this project and will be included in the flow of all documents he may require.

5. FOOD SERVICE DESIGN CONSULTANT: The FOOD SERVICE DESIGN CONSULTANT for this contract represents the OWNER in all matters included and acts as a Technical Advisor to the ARCHITECT. To function effectively, The Food Service Consultant must be advised of any modifications proposed by any party to this Contract, which may affect the performance of this Contract.

6. OWNER: The OWNER'S responsibility in facilitating the performance of this Contract includes:

    a) The designation of a representative who has the ability and authority to render prompt decisions and provide pertinent information.

    b) Informing all parties to this Contract of Critical Dates, Budget Limitations, Outside Contracts, or factors, which could affect the performance of this Contract.

7. OPERATOR: The OPERATOR is a third party contracted under the OWNER who is responsible for the food service operation. The OPERATOR may be responsible to provide some items as identified in the specifications.

8. NOT IN CONTRACT (N.I.C.): If and whenever the abbreviation N.I.C. is used in this Contract, it shall mean the item or items in question ARE NOT PART of this Food Service Equipment Contract.

B. CONTRACT DOCUMENTS:

1. Contract Documents for the F.S.E.C. include:

a) All Food Service Design Consultant Drawings

b) Written Specifications

c) Equipment Cut Book

d) All related Addenda issued prior to execution of this Contract

e) Architect's, Engineer's, and all other Consultant's Plans & Specifications

2. The design documents have been created with the effort and coordination of many disciplines some of which may include the owner and operator. As such, the F.S.E.C. should submit the proposal as specified. Alternates can be suggested in a separate proposal. All Alternates must meet or exceed current expectation and be compatible with MEP data specified. All Alternates must be submitted to the Food Service Design Consultant for review and approval prior to acceptance of proposal. It is the responsibility of the F.S.E.C. to coordinate any MEP changes with other trades because of approved Alternates.

C. OWNERSHIP OF DRAWINGS: All Contract Documents furnished for this project are the property of the Food Service Design Consultant. They are not to be used on any other project, wholly or in part.

D. CONFLICTING OR MISSING INFORMATION: If information presented in this Contract or the Drawings is missing or in conflict, the F.S.E.C. and/or the G.C. shall submit a formal RFI (Request for Information) identifying the conflicting or missing information, along with any recommendation for a solution(s) based on his/her professional experience.

E. CHANGE ORDERS: If it is necessary to alter the contract post award, F.S.E.C. shall submit a Change Order Request to the contracted party documenting the change and costs associated. The change order request must be approved by the Design Team and Owner or Owner's Representative in writing prior to any work commencing or material being ordered.

1.02 LABOR SCOPE OF WORK:

Food Service Equipment required for this work is indicated on the drawings and includes, but is not necessarily limited to the following:

1. Furnish all labor, materials, and services necessary to complete the work described in the documents.

2. LABOR: All onsite labor is to be performed by NON-UNION CONTRACTORS.

3. Supplying and setting in place all new Food Service Equipment as indicated in contract documents. Peel all laser paper, assemble, level, and make ready for final connections.

4. Relocating all Existing Food Service-related Equipment Items as indicated in contract documents.

5. All Food Service Custom Stainless-Steel Equipment is to be fabricated by a NSF certified fabricator.

6. All Food Service Custom Millwork is to be fabricated to meet NSF standards.

7. Silicone seal all gaps between equipment and custom fabrication and walls.

1.03 QUALITY ASSURANCE:

All work shall comply with the following (as appropriate):

1. Underwriters' Laboratories (U.L.)

2. National Sanitation Foundation (N.S.F.)

3. American Society of Mechanical Engineers

4. National Fire Protection Association (N.F.P.A.) Standards Pamphlet No. 96

5. National Electrical Code

6. All applicable National, State and Local Codes

7. Manufacturer's instructions and recommendations

1.04 PRODUCT HANDLING:

A. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other Trades.

B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect or Food Service Consultant at no additional cost to the Owner. Costs shall be presented to the party responsible for damage.

1.05 SUBMITTALS:

A. SHOP DRAWINGS: Shop drawings shall be submitted in accordance with requirements of the General Conditions and shall include, but not be limited to, the following:

1. Floor plans, showing detailed dimensions for utility lines and equipment to a scale of 1/4" equals 1'-0". These dimensions shall be taken from finished walls and centerline of columns and include all electrical and plumbing floor "stub-up", "out of wall" and "Branch to Connection (B.T.C.)" notations for use in the Field.

2. Floor plans, showing detailed dimensions for elevated bases, floor depressions, wall openings, locations of partitions and wall reinforcing as related to equipment supplied under this Section, to a scale of 1/4" equals 1'-0".

3. Dimensioned Equipment Construction Drawings, indicating reinforcement, anchorage and other work required for completion and installation of equipment under this Section, to a scale of 1/4" equals 1'-0".

4. Schedule of Equipment and Connections: Furnish a detailed Equipment Schedule similar to what is shown on Food Service Contract Drawings including all Remarks and General Notes.

5. This Equipment Schedule shall be submitted with the Mechanical Rough-In, H.V.A.C. (C.K.V.) and Special Conditions Drawings (i.e. Floor Penetration Plan and Critical Dimensions/Wall Blocking Plan) as part of the Food Service Shop Drawing Set.

6. Specified Custom Manufacturer’s Shop Drawings, indicating all aspects of their Custom Fabricated Equipment (i.e., Walk-In Boxes and related Refrigeration Systems, Food Service Exhaust Hoods, Ventilation Fans & related Fire Suppression Systems, Commercial Food Service Millwork Cabinetry and Countertops etc.), to a minimum scale of 1/4" equals 1'-0".

7. All required Food Service-related shop drawings shall be submitted electronically via e-mail as PDF Files to all Concerned Parties for review and approval and returned to F.S.E.C. in the same manner.

B. BOOK OF MANUFACTURER’S CATALOGUE CUT SHEETS:

1. All required Food Service-related Manufacturer's standard Catalog Cut Sheets shall be compiled together in booklet form. They shall be arranged numerically by Project Item Number to correspond with the as shown on the Food Service Contract Drawings and listed in the "Schedule of Food Service Equipment".

2. All Cut Sheets shall be preceded by a corresponding Cover Sheet. Each Cover Sheet and shall include the Item Number, Model Number, Manufacturer's Name and all specified options and accessories.

3. The Cut Book shall be submitted electronically via e-mail as a PDF File to all Concerned Parties for review and approval and returned to the Food Service Equipment Contractor (F.S.E.C.) in the same manner.

C. SUBMITTAL STANDARDS:

1. Reproductions or enlargements of Food Service Contract Drawings submitted for use in lieu of proper shop drawings as hereinbefore described will be not acceptable.

2. Details for all Custom Fabricated Food Service Equipment shall include fully detailed plan, elevation, and section views of all applicable specified Items.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. STAINLESS STEEL: Shall be Type 304, No. 4 finish unless otherwise specified.

B. FASTENINGS: All bolts, screws, nuts, and washers shall be stainless steel, except that where brass is to be fastened, the fastenings shall be brass. Where dissimilar metals are fastened, bolts, screws, and nuts shall be made of an approved non-corrosive metal.

C. STAINLESS STEEL COUNTERTOPS: When specified, each shall be 14-gauge stainless steel, unless otherwise specified and shown on Food Service Design Drawings.

D. MILLWORK CABINET SUBSTRATE: Shall be of Marine Grade Plywood, manufactured with a formaldehyde-free adhesive system, which meets physical properties of ANSI A208.2-2009 Grade 155 Specifications.

2.02 WORKMANSHIP:

A. FASTENERS: Except as otherwise specified or approved by the Architect and the Food Service Consultant, exposed finished surfaces shall be free from bolts, screws, and rivet heads. Wherever threads of bolts and screws occur on the inside of fixtures and are either visible or might come in contact with hands or wiping cloths, such bolts and screws shall be capped with a suitable lock washer and chrome plated brass or bronze acorn nut.

Where screw threads are welded to the underside of trim and tops, their spacing and intent of rivets, bolts, and screws shall be such as to ensure proper fastening and prevent bulging of the materials fastened.

B. WELDS: Shall be continuous, strong, and ductile, with excess metal ground off joints finished smooth to match adjoining surfaces. All joints in tops of fixtures, tables, drain boards, over shelves, sinks and other equipment shall be welded unless otherwise specified. Wherever material has been depressed by a welding operation, such depressions shall be suitably

hammered and peened flush with the adjoining surface and, if necessary, be ground again to eliminate low spots.

1. GRINDING: Care shall be exercised in all grinding operations to avoid excessive heating of the metal, causing discoloration. In all cases, the grain of rough grinding shall be removed by successive polishing operations.

   Wherever such break bends occur, they shall be free of undue extrudence and shall not be flaky, scaly, and cracked in appearance. Where such breaks mar the uniform surface appearance of the materials, all such marks shall be removed.

2. EDGES/MITERS/CORNER: Sheared edges shall be free from burrs, fins, and irregular projections, and shall be finished to obviate all danger of cutting and laceration when the hand is drawn over the edge. Miters and bull nosed corners shall be welded.

3. WELDING SCHEDULE: All Welding shall be performed during night or weekend hours as coordinated with the General Contractor, unless otherwise permitted by the Operations or Construction schedule.

   Food Service Equipment Contractor to provide Fire Safety Watch whenever welding is done.

C. ACCESS PANELS: Provide all access panels which may not be specifically mentioned in the specifications or shown on drawings, but which are required for the proper functioning or service of the equipment. If an access panel is to be provided that is customer facing Architect and Food Service Design Consultant must approve specification and location.

2.03 CUSTOM FABRICATED STAINLESS-STEEL EQUIPMENT:

A. SINKS, DRAINBOARDS & DISHTABLES: Unless otherwise specified, all sinks, drain boards and dish tables shall be constructed of 14-gauge stainless steel as follows:

1. Joints shall be welded. Front and ends, unless otherwise indicated on drawings, shall be extended 3 inches, measured at sink edge, and rolled on a diameter of 1-1/2 inch, 180°. Raised, rolled rim at front, and ends of drainboard shall be leveled with sink rolled rim and continuous there with and shall not follow the pitch of the drainboard. Typically, drain boards shall be pitched 1/8" per 1'-0" towards sink compartments.

2. Sinks and drainboards adjacent to walls or adjoining equipment shall have 10-inch high backsplash, level and continuous, not following the pitch of drain boards.

3. All sinks to be die-stamped or deep-drawn construction.

B. STAINLESS STEEL LEG MOUNTINGS:

1. Units mounted on legs that are 14 inches or longer shall be provided with underbracing

2. Gussets shall be stainless steel, die-stamped, fully enclosed, drawn cylindrical or cone shaped of not less than 3 inches length, 21/2 inches in diameter at top. Gussets shall be welded continuously around entire circumference against the channel reinforcement.

C. STAINLESS STEEL FEET: Each shall, typically, be stainless steel bullet type, having an integrally formed shaft with a minimum adjustment of approximately 11/2 and be completely sealed and closed fitting between tubular leg support & foot. When specified or required by local code, stainless steel flanged-type feet shall be furnished instead of bullet-type to positively secure oversized equipment items to the floor.

Flanged feet shall be fabricated with round mounting holes to accept standard screw-type fasteners that can be easily accessed for installation.

D. STAINLESS STEEL UNDERSHELVING:

1. Flat under shelving for custom fabricated tables shall be 16-gauge stainless steel, turned down on front and sides approximately 11/2 inches and under 1/2 inch to form a channel shape. Rear of shelf to be turned up 2 inches and hemmed.

2. Counter interior shelves and cabinet shelves shall be constructed of 16-gauge stainless steel. All shelves shall be of the removable type unless otherwise specified or shown on drawings and constructed in sections of not more than 30 inches in length for easy removal and cleaning.

E. STAINLESS STEEL SHELVES:

1. If wall-mounted, General Contractor shall furnish and install Wall Blocking required to support all wall shelves. All Wall Blocking shall be of appropriate size, shape and material as hereinafter specified and shown on Food Service Design Drawings. This blocking shall be mounted within building walls and concealed from view by the selected wall finish material.

2. If surface-mounted, uprights shall be mechanically fastened to understructure of table or counter so as to prevent any movement of overshelf. Seams to be silicone sealed around the entire perimeter.

F. STAINLESS STEEL COUNTERS:

1. STAINLESS STEEL TOPS: Counters shall have 14-gauge tops and 18-gauge bodies, unless otherwise specified or shown on drawings.

2. STAINLESS STEEL SERVING COUNTER CONSTRUCTION: Counters shall be of “All-Welded” (aka “Uni Welded”-type construction). Tops shall be turned down 2 inches on all sides. Corners and edges shall be rounded.

3. STAINLESS STEEL INTERIOR SHELVES: Interior cabinet sections to be provided with 18-gauge stainless steel bottom and (whenever feasible) adjustable intermediate shelves. Intermediate shelves shall be adjustable, 30” inches deep (maximum) and a rear 2” turn up for easy reach.

4. ACCESS TO CABINET INTERIOR: Cabinets where interior access to Utility Lines (i.e. Plumbing, Electric or Data Communication Lines) is required shall have removable access panels on the interior of the cabinet every 60” maximum with a minimum of 1 per cabinet. Access panel to be a minimum of 24” by 24”.

5. EQUIPMENT TEST FITTING: The F.S.E.C. shall ship all Food Service Equipment being built into counters to the Contractor’s Fabrication Shop. All equipment to be pre-fitted into each counter opening prior to shipping the fabrication.

6. ROUND PENETRATIONS FOR UTILITY LINES: All penetrations in counter tops shall consist of holes fitted with color coordinated rubber or plastic grommets. F.S.E.C. to properly size all required holes. Whenever possible, each hole with grommet shall be positioned in a concealed location.

7. LEGS FOR STAINLESS STEEL COUNTERS: All stainless-steel counters shall be supported on 6-inch high, heavy-duty stainless steel legs with adjustable bullet feet, affixed to underside of counter body and spaced no more than 5’-0” apart on centers.

G. STAINLESS STEEL CABINET DOORS:

1. Doors shall be constructed of 18-gauge stainless steel exterior and 20-gauge stainless steel interior unless otherwise specified and be a minimum of ½” thick.

2. Doors shall be double pan construction with all corners welded and polished and shall be filled with an approved 1/2-inch-thick sound deadener.

3. All doors and/or removable panels specified to enclose self-contained compressor compartments and/or high heat compartments shall be fabricated with stainless steel louvers.

   The F.S.E.C. shall be responsible to ensure that the final location, quantity, style, shape and overall size of each louvered door and/or panel will be sufficient to ensure that proper ventilation will be provided for the intended Food Service Equipment item per manufacture’s specific requirements or better.

H. VENTILATION FANS (if specified on drawings):

1. If counter is fully enclosed on all four sides, Fabricator to provide ventilation fans. Ventilation fans to be spaced to allow for proper air flow and expel excess heat.

2. These fans shall be mounted and hard wired by E.C. to ensure device turns on with the equipment it is servicing.

3. Fan sound not to exceed 30 decibels during normal operation.

4. Fan Specifications:

NMB Technologies
4715FS-12T-B50-D00
Motor Structure: Shaded Pole Induction Motor
Motor Protection: Impedance Protection
Insulation Resistance: 10M Ohm or over with DC500VMegger
Dielectric Withstand Voltage: AC 700V 1s
Allowable Ambient Temperature Range:
-10 degree C ~ +70 degree C (Operating)
-40 degree C ~ +70 degree C (Storage)
(non-condensing environment)
Casing: Aluminum Black Painting
Impeller: Plastic (Black) UL94V-0
Lead Wire or Terminal: AWG22, UL3266 CSA CL1252
Faston #110 or equivalent

2.04 CUSTOM FABRICATED MILLWORK EQUIPMENT:

A. MILLWORK CABINETS:

1. MILLWORK CABINET JOINERY: All Millwork Cabinetry shall be built using Butt Joint-type Construction. Cabinetry shall be ¾" marine grade plywood construction.

All joints shall be fastened with a combination of screws and staples. In addition, Wood Glue shall be used at all wood-to-wood joints. Wood Glue shall maintain continuous and full surface to surface contact across all edges.

All field joints will comprise of double vertical panels connected using hex head bolt, washer and nut or all metal furniture connecting bolt systems (similar to CON-928 as manufactured by Outwater Hardware or approved equal). Field joints must be tight and flush.

Cabinetry to be built in lengths that support practical delivery and installation while minimizing field joints. Field joints should be located to minimize customer visibility.

All field joints (millwork and countertop surfaces) as well as finish seams must be identified in the provided shop drawings.

2. MILLWORK CABINET INTERIOR FINISH & SHELVING: Unless otherwise specified and shown on Food Service Design Drawings all Millwork Cabinet interior and shelves shall be furnished with Vertical Grade H.P.L. (High Pressure Laminate) or Melamine in a standard color identified by product number and name as specified by Architect and/or sown on drawings. Intermediate shelving shall be adjustable, and bottom shall be fixed.

3. MILLWORK CABINET TOE KICK BASES & LEG SUPPORT: Toe Kick Bases shall be constructed using Marine Grade Plywood 6" High or heavy-duty stainless-steel legs with adjustable feet. Legs shall be spaced no more than 5 feet apart. If the General Contractor is providing a tile and/or cove base finish the exterior can be left unfinished and suitable to receive finish material. Otherwise toe kick should be finished in #4 stainless steel vertical graining or Vinyl Cove Base (VCB) as called out on the foodservice and/or Architectural drawing.

4. MILLWORK CABINET VERTICAL EXTERIOR SURFACES: The exterior vertical surfaces of all Millwork Cabinetry including exposed ends, and cabinet frame edges shall be finished per Architectural and/or Foodservice drawings. Any unfinished exposed wood is not permissible.

5. MILLWORK DOOR CONSTRUCTION & FINISHES: All Millwork hinged doors shall be fabricated of ¾" Marine Garde Plywood. The front, edge and rear of doors will be fully finished matching the adjacent finishes cabinetry.

6. MILLWORK DOORS & REMOVEABLE PANELS FITTED WITH VENTILATION SLOTS: All Millwork hinged doors and/or removable panels specified to enclose self-contained compressor compartments located within counter bodies shall be routed with slots in millwork for ventilation as shown on drawing elevations. The slots for ventilation are required to expel excessive heat generated by the normal operation of the Foodservice equipment in the cabinets. Locations and size to be determined by the Foodservice cabinet manufacturer and/or the F.S.E.C. as needed. All ventilation slots are to be called out on shop drawings indicating opening size of slots. Interior of slots to be painted with matching color to adjacent exterior finish.

7. VENTILATION FANS INSIDE MILLWORK CABINETS: Shall be same as specified for Stainless Steel Counter Constructions under SECTION 2.03, Sub-Section "I".

8. MILLWORK CABINET ACCESS PANELS:

   a) When rear access to cabinet is not possible and access is required for utilities, service, or installation the Millwork Base Cabinetry shall be furnished with flush mount removeable panels to allow for access to the cabinet interior. Access panels shall be made for access to any controls or utility lines as needed.

   b) Unless otherwise specified or shown on drawings, all removable panels shall be a minimum of 24 inches and a maximum of 36 inches in length and equal in length to any adjoining removable panels.

   c) All removable panels shall have the same millwork construction and finish as specified for the adjacent millwork cabinetry.

   d) All access panels shall be clearly noted, located, and sized on shop drawings.

B. SOLID SURFACE/QUARTZ COUNTERTOPS & SPLASHES:

1. SOLID SURFACE/QUARTZ COUNTERTOP CHARACTERISTICS: All tops and splashes shall be furnished in sizes, shapes, colors, and patterns in standard 3cm thickness or as specified and shown on drawings unless otherwise noted. Each top shall be furnished and installed by a Factory Authorized Dealer of this material.

2. SOLID SURFACE/QUARTZ COUNTERTOP MOUNTING: Each solid surface/quartz top and splash shall be affixed to the counter body below in an approved manner using color-coordinated seam adhesive and silicone. Rach top shall be supported using Millwork Cabinet Substrate or steel plate as required per the manufacturer's fabrication and installation instructions.

3. SOLID SURFACE/QUARTZ COUNTERTOP EDGES: All solid surface/quartz tops and splashes shall have all exposed edges finished in a matching "Eased-Type" Edge, unless otherwise specified and/or shown on drawings. All corners shall have matching radius edges.

   All unexposed edges of tops and splashes shall be finished square and smooth. All edges meeting building walls or other partitions shall be scribed in the field during installation to accommodate adjacent finished surface of wall or partition. Resulting solid surface/quartz edge(s) shall be sealed to walls or partitions using a matching, color-coordinated, approved silicone seam adhesive, in an approved manner.

4. QUARTZ COUNTERTOP SEAMS: Any field seams required for Solid Surface/Quartz countertops shall be kept to a minimum and clearly identified in shop drawings. Furthermore, the location should be selected to minimize visibility and structural instability. All seams shall be filled using color coordinated seam adhesive made for use with solid surface/quartz material. Seams should be tight and flush.

5. SOLID SURFACE/QUARTZ COUNTERTOP FABRICATION & INSTALLATION: Countertop and matching splash to be fabricated and installed in accordance with any and all instructions mandated by the specified manufacturer. This includes, but not limited to, the proper installation of thermal breaks to maintain proper tolerances for heat/cold rejection.

   The F.S.E.C. assumes all responsibility in the furnishing and installing of this material in accordance with the manufacturer's guidelines for use in a Commercial and/or Institutional Food Service Facility.

6. MILLWORK CABINET ACCESS PANELS:

   a) CUT-OUTS: Top and interior body of counter to be cut out and have any other openings, as required, to accept any and all "Buy-Out" Food Service Equipment and related components as specified. All "cut outs" and opening shall be furnished in an approved and safe manner to maintain structural integrity of the top and allow for proper installation

      All interior corners of cut outs to be rounded corners to prevent cracking.

IMPORTANT: Unless otherwise directed, the F.S.E.C. shall coordinate and confirm that all related Food Service Equipment will be shipped to Millworker's Fabrication Shop to be pre-fitted into each corresponding counter opening PRIOR to each counter leaving shop and/or being installed at the Jobsite

b) ROUND PENETRATIONS FOR UTILITY LINES: Unless otherwise specified or shown on drawings, all penetrations in countertops required to vertically run utility line (i.e. Plumbing, Electric and Data Communication Lines) shall consist of round holes fitted with color coordinated rubber or plastic grommets. F.S.E.C. to properly size all required holes.

Whenever possible, each hole with grommet shall be positioned in a concealed location that prevents obvious viewing by Workers and Patrons.

C. MILLWORK WALL CABINETS:

1. Custom Millwork Wall Cabinets shall be of length and configuration as shown on drawings or specified. Typically, these cabinets shall measure 13 inches deep x 30 inches high, (except if otherwise specified or shown on drawings).

2. Construct cabinets of matching millwork fabrication details and materials as described earlier. Exterior bottoms shall be of flush construction. All cabinets shall have sloped tops to reduce dust build up.

3. All Wall Cabinets shall be of rectangular box construction with enclosed rear and ends. Each cabinet shall be provided with a fixed bottom shelf and removable and adjustable intermediate interior shelves. Quantity to be as specified on elevation drawings.

4. All removable and adjustable intermediate interior cabinet shelves shall be of similar construction as specified for shelves located inside millwork counters.

5. All hinged or sliding millwork doors for custom wall cabinets shall be fabricated in the same manner and furnished with the same hardware (i.e. handles, locks, hinges, etc.) as similar doors specified for Millwork Counters.

6. General Contractor shall furnish and install Wall Blocking required to support all wall cabinets. All Wall Blocking shall be of appropriate size, shape and material as specified and shown on the Foodservice Design Drawings. This backing shall be mounted within building walls and concealed from view by the selected wall finish material.

2.05 TRAYSLIDES (WHEN SPECIFIED):

1. The surface of all trayslides shall not exceed 2'-10" above finished floor.

2. Stainless Steel trayslides shall be fabricated of 14-gauge flat sheets with inverted "V" ribs.

3. Trayslides shall be mechanically fastened to counter body, utilizing equally spaced brackets.

4. Any field seams shall be kept to a minimum.

5. Stainless steel trayslides to be fully welded and blended polished for a seamless appearance.

6. Trayslide ends meeting building walls or other partitions shall be sealed to walls or partitions using matching, color-coordinated silicone sealant.

2.06 HARDWARE:

1. All doors to be provided with Magnetic type catches.

2. All doors to be provided with cylinder type locks with Chrome finish, keyed alike.

3. Door hinges to be concealed type Salice model C2R6D99, ½" with 110 degree opening, with back plate Salice model 329.71.503, ¼" overlay.

4. Door Pulls to be tab style Hafele model 124.02.432, measuring 70mm x 42mm x 18mm, aluminum with satin finish. Route interior of door for a flush mount installation.

5. All mobile millwork to be specified with Component Hardware group C31-2061 heavy duty 4" x 4-1/2" plate caster with 6" polyurethane wheel with brake.

6. All drawer slides to meet NSF standards.

7. All shelf supports to be Component Hardware group series #T21-1 keyhole type pilasters in lengths as required with matching clips.

PART 3 – EXECUTION

3.01 SITE CONDITIONS:

PRE-INSTALLATION SURVEY:

1. All dimensions shown in Contract Documents, must be verified and confirmed by the Food Service Equipment Contractor (or any other specified Contractor) prior to start of Fabrication.

2. Prior to all work of this Section, The Food Service Equipment Contractor shall visit the Jobsite to carefully inspect the installed work of all other Building Trades and verify that all such work is complete to the point where installation of all Food Service-related equipment and/or furniture and fixtures included in this Section may properly commence.

   Should the F.S.E.C. determine that delivery and/or installation of these items cannot yet commence, they shall immediately notify the appropriate Parties involved (i.e. General Contractor, Architect, Food Facilities Designer and/or the Owner, etc.) to resolve all outstanding issues contributing to that determination.

3. The F.S.E.C., prior to fabrication shall confirm the delivery path is adequate for delivery of items within the scope of work. Should any discrepancies arise please issue an RFI to construction and design teams.

3.02 INSTALLATION:

1. The installation shall be supervised by an Approved Representative of the F.S.E.C. and in accordance with the specifications and directions provided by the various manufacturers/fabricators.

2. The F.S.E.C. shall coordinate with the General Contractor to ensure that their delivery and/or installation of these items coincides with the schedule issued by the General Contractor. Should any conflict arise the F.S.E.C. should provide in writing the conflict and proposed resolution. The two or more parties shall come to a mutually agreed upon resolution. Should the resolution not be attainable, conflict shall be escalated to the entire Design, Construction and Client team for final determination.

3.03 PROTECTION OF WORK:

1. For the period during which other Building Trades shall be on or near equipment, furniture, fixtures and/or Trade Work covered by this Section, the F.S.E.C. shall cover and otherwise protect the exposed surfaces of such items. This protection shall be done in a manner that shall preclude injury to the finish of these items by absorption of oil, grease, chemicals, etc., contact from tools and machinery, and from all other causes, which may be incidental to this and any other work being performed in the area.

2. The party responsible for above mentioned damage shall absorb all expenses for repairing and/or replacing damaged goods and/or the labor cost associated with removal, disposal and/or reinstallation as required.

3. During deliveries, the F.S.E.C. is responsible for protecting all adjacent finishes to delivery path except when in a designated loading dock, freight elevator and/or service corridors.

3.04 CLEANING:

1. The F.S.E.C. is responsible to maintain a reasonably clean workspace. At the daily completion of work, area should be free and clear of all debris and tooling and left in broom swept condition.

2. All materials to be disposed of shall be done so as directed by the General Contractor in accordance with guidelines explained in the Construction Contract for work of this Section. If Construction Contract does not include this clarification, the F.S.E.C. shall issue an RFI prior to proposal submission.

3. The Owner is responsible for a full sanitizing deep clean at the completion of construction and prior to opening.

3.05 TESTING & START-UP OF EQUIPMENT & FIXTURES:

1. The F.S.E.C. is responsible to test all equipment to ensure it is functioning as designed. Should any equipment be malfunctioning, the F.S.E.C. is responsible to schedule a service call and/or repair with manufacturer’s authorized service agent. If the repair is due to a manufacturer defect, it will be covered under warranty. If the issue is found not to be covered under manufacturer warranty, the responsible party shall be billed accordingly.

2. The F.S.E.C. will coordinate with manufacturers and/or service agents for startups prior to opening when indicated on the schedule of Equipment in the Food Service drawing set.

3. The F.S.E.C. will coordinate with manufacturers reps for demonstrations as deemed necessary by the Operator prior to opening.

3.06 WARRANTY REPAIRS OF EQUIPMENT, FURNITURE & FIXTURES:

GENERAL WARRANTY REPAIRS:

1. Owner is to be provided with a Warranty Repair Service covering parts and labor for a minimum of (1) year.

2. All work under this Warranty Repair Service shall be performed by Factory Authorized Service Personnel.

3. All no cost Warranty work shall be performed during the Service Agent's normal operating hours. Service required during premium hours is to be billed to the Owner. Owner is to approve after hours service before it is conducted.

3.07 CLOSE OUT PACKAGE:

Digital close-out package should be submitted to the Owner, Operator, and any other required parties. This package should include the following:

a. Manuals
b. Warranty Letters
c. Cut Book
d. As Built Drawing Set
e. As Built Shop Drawings
f. Serial Number Listing (as available)

3.08 EXISTING FOOD SERVICE-RELATED EQUIPMENT, FURNITURE & FIXTURES:

1. EVALUATION OF EXISTING ITEMS: All existing to be re-used Food Service Equipment shall be evaluated by the FOOD SERVICE EQUIPMENT CONTRACTOR to confirm current working operation.

2. If equipment is not in working operation, change order should be submitted for replacement or repair as appropriate.

PART 4 – SPECIFICATION

4.01 DEFINITIONS:

1. Each model number includes the code *E024 after SIS (Specifier Identification System). Its purpose is to identify the specifier to the vendors providing the equipment in the event it is necessary to communicate questions, clarifications, and comments. It is to be used on all correspondence including fax and email when communicating with manufacturer representatives and factories. For more information, contact NAFEM Headquarters.

2. NOTE TO HEALTH DEPARTMENT EXAMINERS: The SIS identifier is a supplement to NSF's nationally recognized model numbers. It will be attached to the individual item specification by an asterisk and then the identifier code. It does not modify the approved model number

4.02 ITEMIZED SPECIFICATION:

The following is a specification for each piece of equipment in the scope of work identified by the corresponding item number in the equipment plan.

ITEM A01 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Length (In): 144
Hood Width (In): 66
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 276
Supply Plenum: Yes

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM A01.1 - MAKE UP AIR DIFFUSER (2 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to A01 for specifications.

ITEM A01.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A01 for specifications.

ITEM A01.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A01 for specifications.

ITEM A01.4 - WALL-MOUNTED MANUAL HOOD FILTER REMOVAL TOOL (1 REQ'D) <Included>
SIS No.: *E024

Halton Model TO BE DETERMINED
Refer to A01 for specifications.

ITEM A01.5 - S/S WALL PANELS (1 REQ'D) <Included>
SIS No.: *E024

Custom Model CUSTOM
Refer to A01 for specifications.

ITEM A01.6 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # A01

ITEM A01.7 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # A01.6

ITEM A02 - DOUBLE-STACK GAS COMBI OVEN (1 REQ'D)
SIS No.: *E024

RATIONAL Model ICP 6-FULL ON 6-FULL NG 208/240V 1 PH
Two (2) (CC1GRRA.0000238) iCombi Pro® 6-Full Size Combi Ovens, double stack, natural gas, (12) 18" x 26" sheet pan or (24) 12" x 20" steam pan or (12) 2/1 GN pan capacity, (6) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 106,500 BTU each, 208/240v/60Hz/1-ph, 6 ft. cord, 0.9 kW each, CE, IPX5, cCSAus, NSF, ENERGY STAR-®

1 kt	Model 60.75.752 Combi-Duo Universal Stacking Kit, for iCombi 6-half size or 6-full size (electric or gas) on iCombi 6-full size (gas only)
1 ea	Model 60.31.204 Stand I for Combi-Duo, mobile, 7-3/4"H, all sides open, stainless steel construction, height adjustable casters, for iCombi 6-full size on 6-full size
1 ea	Model 87.00.732US Safety-Set, Equipment placement system for all casters-mounted equipment, allows precise, consistent equipment placement for drain lines to floor sinks and under the fire suppression in ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes tow (2) pieces and installation pack. THIS ITEM IS NON_DISCOUNTABLE (NET)

1 ea	NOTE: All discounts subject to approval by manufacturer
1 ea	2 years parts and labor, 5 years steam generator warranty
2 ea	Model 9999.9613 K-12 Extended Warranty: Extends the warranty for 12 months beyond the Original Equipment Warranty to 3 years parts and labor. (NET)
1 ea	Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
1 ea	Model 9999.2002 Pre-Installation Site Consultation, provides an installation consultation to ensure the site has proper space and connections for gas, electric, drain & water, one (1) Consultation is needed for every four (4) cooking systems, add 'in one (1) kitchen', includes 100 miles (200 miles round trip). (see attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
2 ea	Model 9999.2252 RCI RATIONAL Certified Installation, new certified installation for each table-top iCombi of a combi-duo, 100 miles (200 round-trip) included. (See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
1 ea	Model 9999.2003 Second Installation Trip – only with RATIONAL Certified Installation when separate dates are required. Includes up to 4 cooking systems in one kitchen. Includes 100 miles (200 miles round-trip). THIS ITEM IN NON-DISCOUNTABLE, USA ONLY (NET)
2 ea	Model 8720.1560US Installation Kit, for gas iCombi/SCC/CMP 101G (120/60Hz/1ph); gas iCombi/SCC/CMP 62G (208-240/60Hz/1ph); gas iCombi/SCC/CMP 61G (120/60Hz/1ph) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
1 ea	Model 1900.1158US Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
1 ea	Model 9999.2271 RCI RATIONAL Certified Installation, additional installation cost for a RATIONAL Water Filter System is available when purchased with Certified Installation of RATIONAL unit THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
1 ea	Note: The RATIONAL Water Filtration Systems helps provide consistent high-quality water to your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines, and chlorine while delivering the required flow rates.
1 ea	NOTE: All public water systems using surface water and most ground water systems treat with either chlorine/chloramine or chlorine dioxide (EPA will allow levels as high as 4ppm safe for drinking water, exceeding our maximum level of .2ppm.
1 ea	NOTE: Chloride concentrations above 80ppm can cause corrision. RATIONAL Water Filtration does NOT reduce chloride
1 ea	Free Water Testing Kits are available (contact factory for info)
2 ea	Model 1900.1155US Water Filtration Cartridge, replacement or add on with additional Modular Head to Double Cartridge System, includes: (1) R95-CLX filter
1 ea	Model 56.01.535 Active Green Cleaner Tabs, for all iCombi Pro/Classic, 150 pieces/bucket (minimum order quantity- 2 ea, unless ordered with a unit) (NET)
1 ea	Model 56.00.562 Care Tabs, bucket of 150 packets for all iCombi Pro/Classic models and SelfCooking Center® units from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity: 2pcs, unless ordered with a unit) (NET)
1 ea	Model 60.76.316 Sous-Vide Core Temperature Probe, USB connection, for 6, 10, and 20 Full and Half size models
2 ea	Model 60.75.768 Heat Shield, for right side panel, type 6-full size Pro/Classic, 2"W, stainless steel construction
2 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
2 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM A02.1 - ADDITIONAL UTILITY INFORMATION FOR TOP (1 REQ'D) <Included>
SIS No.: *E024

RATIONAL
Refer to A02 for specifications.

ITEM A02.2 - WATER FILTER (1 REQ'D) <Included>
SIS No.: *E024

RATIONAL Model 1900.1158US Dimensions: 24.63(h) x 18.5(w) x 5.38(d)
Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)

1 ea	NOTE: The RATIONAL Water Filtration Systems helps provide consistent high quality water to your RATIONAL SelfCooking Center or your CombiMaster Plus. The patented carbon block technology reduces the effects of sediment, chloramines and chlorine while providing the required flow rates

ITEM A03 - PASTA COOKER (1 REQ'D)
SIS No.: *E024

Omcan USA Model 47714 Dimensions: 46.9(h) x 15.6(w) x 35.4(d)
(CE-CN-0011-NG) Pasta Cooker, gas, (1) 11 gallon capacity (41.6 liter), sliding front door for water refill and waste outlet, (6) stainless steel baskets with coated handles, stainless steel construction, non-slip feet, 70,000 BTU, cETLus, ETL-Sanitation

1 ea	1 year parts & labor warranty, standard
1 kt	BK Resources Model BKG-GHC-5048-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 1/2" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM A04 - REFRIGERATED EQUIPMENT STAND (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MGF8452GR Dimensions: 26.6(h) x 60.5(w) x 33(d)
Atosa Chef Base with Extended Top, one-section, 60-1/2"W x 33"D x 26-3/5"H, side-mounted self-contained refrigeration, 8.4 cu. ft., (2) self-closing drawers with recessed handles, digital temperature control, 34° to 40°F temperature range, includes (6) 12 x 20 stainless steel pans, stainless steel interior & exterior, 5" casters, R290 Hydrocarbon refrigerant, 1/7 HP, 2.3 amps,115v/60/1-ph, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea	2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)
1 ea	1/6 size, 6" deep metal pans and dividers included (see specsheet for exact pans included per model)

ITEM A05 - 36"W COUNTERTOP GAS GRIDDLE (1 REQ'D)
SIS No.: *E024

Star (Middleby) Model 636TF Dimensions: 15.5(h) x 36(w) x 29(d)

(MIDDLEBY ESSENTIALS ITEM) Star-Max® Heavy Duty Griddle, gas, countertop, 36" W x 21" D cooking surface, 1" thick polished steel griddle plate, embedded modulating thermostat every 12", heavy duty knob, wrap-around stainless steel splash guard, grease trough & stainless steel drawers, welded steel frame with stainless steel front, 4" legs, 84,900 BTU, cULus, UL EPH Classified, Made in USA, (ships Natural gas includes LP conversion kit)

1 ea	Quick Ship items have limited configurations & that standard configuration may not apply. Contact factory for details
1 ea	2 year parts & labor warranty, standard
1 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM A06 - 24"W COUNTERTOP GAS CHARBROILER (1 REQ'D)
SIS No.: *E024

Turbo Air Model TARB-24 Dimensions: 10(h) x 24(w) x 30(d)
Radiance Charbroiler, countertop, gas, 24" wide, 16 ga. stainless steel front plate & wrap, heavy duty cast iron radiant & grate, (4) burners with manual controls, removable grease pan, bullnose stainless steel front extension, heat resistant on-off knob, 2" stainless steel standard legs, regulator included, total 60,000 BTU, CSA, CSA-Sanitation

1 ea	Note: Contact factory representative for parts & accessories discounts
1 ea	1 year labor & parts warranty, standard
1 ea	Natural gas
1 ea	Model RCP1002 Regulator, Natural Gas / LP Gas Convertible
1 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM A07 - S/S MOBILE WORK TABLE (1 REQ'D)
SIS No.: *E024

BK Resources Model SVTOB-1836 Dimensions: 36(h) x 36(w) x 18(d)
Work Table, 36"W x 18"D, 18/430 stainless steel top, with turndown edges on all sides, reinforced with channels, open base with stainless steel side & rear bracing, 1-5/8" dia. stainless steel legs, stainless steel over plastic adjustable bullet feet, ships KD, NSF

1 kt	Model 5SBR-RA-PLY-PS4 Caster Kit, work table 5" diameter expanding stem, fits 1-5/8" OD tubing, non-marking polyurethane tread, top lock brake, 300 lb. capacity, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180° F, zinc plated, POP box, NSF (4 per kit)

ITEM A08 - WALL-MOUNTED S/S HAND SINK (5 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)

Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM A08.1 - WALL-MOUNTED SOAP DISPENSER (5 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM A08.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (5 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM A09 - BUG LIGHT (1 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM A10 - REACH-IN REFRIGERATOR (4 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MBF8005GR Dimensions: 81.3(h) x 51.7(w) x 31.7(d)
Atosa Refrigerator, reach-in, two-section, 51-7/10"W x 31-7/10"D x 81-3/10"H, top mount self-contained refrigeration, 43.2 cu. ft. (2) locking hinged solid doors, digital temperature control, 33° to 40°F temperature range, (6) adjustable shelves, interior LED lighting, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 4" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.2 amps, cord with NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®
4 ea 2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM A11 - REACH-IN FREEZER (1 REQ'D)
SIS No.: *E024

Arctic Air Model AF49 Dimensions: 82.75(h) x 54(w) x 32.75(d)
Freezer, reach-in, two-section, 54"W, 49.0 cu. ft. capacity, electronic thermostat with digital LED display, -10°F to +10°F temperature range, (2) solid hinged self-closing doors with locks (field reversible), remain open door feature, removable magnetic door gasket, (6) adjustable wire shelves, stainless steel front & sides, white aluminum interior with stainless steel floor, (4) 5-1/2"" casters (2 locking), bottom mounted self-contained refrigeration, R290 refrigerant, 1888 BTU/h rejected heated air gain, 7/8 HP, 115v/60/1-ph, 9.0 amps, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®
1 ea 2 year parts & labor, 5 years on compressor warranty standard
1 ea Any Arctic Air model installed in mobile application such as concession trailers, food trucks, etc. or in an outdoor venue shall be limited to one (1) year parts, labor, & compressor warranty only. Models ACP40, ACP48, ACP55, ACP63, ACP4SQ, & ACPSQ are limited to one (1) year parts & labor coverage. Models AWR25 and AWF25 are limited to one (1) year parts & labor coverage and five (5) year compressor warranty.

Light bulbs, door gaskets, etc... are limited to a 90-day warranty period & door hinges to a one (1) year period. The warranty is not valid for Residential use.

1 ea Standard warranty only

1 ea 6" casters (2 locking), set of 4, standard

ITEM A12 - S/S MOBILE WORK TABLE (3 REQ'D)
SIS No.: *E024

BK Resources Model SVT-6030 Dimensions: 36(h) x 60(w) x 30(d)
Work Table, 60"W x 30"D, 18/430 stainless steel top, with turndown edges on all sides, reinforced with channels, adjustable stainless steel undershelf, 1-5/8" dia. stainless steel legs, stainless steel over plastic adjustable bullet feet, NSF

3 kt Model 5SBR-RA-PLY-PS4 Caster Kit, work table 5" diameter expanding stem, fits 1-5/8" OD tubing, non-marking polyurethane tread, top lock brake, 300 lb. capacity, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180° F, zinc plated, POP box, NSF (4 per kit)

ITEM A13 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVW
Hood Quantity: 2
Hood Length (In): 150
Hood Width (In): 74
Hood Height (In): 24
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 748

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM A13.1 - MAKE UP AIR DIFFUSER (4 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to A13 for specifications.

ITEM A13.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A13 for specifications.

ITEM A13.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A13 for specifications.

ITEM A13.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Items # A01, A13

ITEM A13.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # A13.4

ITEM A14 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Quantity: 4
Hood Length (In): 150
Hood Width (In): 60
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 840
Internal End Cutouts - 4

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM A14.1 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM A14.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A14 for specifications.

ITEM A14.3 - MODULATING DAMPER (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A14 for specifications.

ITEM A14.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # A14

ITEM A14.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # A14.4

ITEM A15 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
w/ Lights, Hood Supports By Hood Installer

ITEM A15.1 - MAKE UP AIR DIFFUSER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to A15 for specifications.

ITEM A15.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A15 for specifications.

ITEM A15.3 - MODULATING DAMPER (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A15 for specifications.

ITEM A15.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # A15

ITEM A15.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item A15.4

ITEM A16 - MOBILE COUNTER (25 REQ'D) <Alternate>
SIS No.: *E024

Vollrath Model 29406-1Z
48"x36"x34" Utility Stations
* Stainless Steel Base Construction
* Removable Stainless Steel Toe Kick - 18 Gauge
* 5" Heavy Duty Casters - Locking
* Stainless Steel Flooring - 16 Gauge
* Stainless Steel Under Counter Shelving
* Stainless Steel Base Cabinet
* Custom Locking Hinged Doors with Self Closing Hinges (x2)
* Base Décor - Marlite FRP Panel (#310 "Sierra Maple") Mounted
on 3/4" Plywood with Stainless Steel Rear
* Dekton Quartz Countertop (PRE-INSTALLED IN FACTORY) - Color="LIMBO"
* No Electrical Service
* No Equipment
* Refer to Detail Drawings for Specific Sizing and Construction Details
Provide add alternate pricing to upgrade to Vollrath specification from BK Resources specifcation

ITEM A16 - MOBILE COUNTER (25 REQ'D)
SIS No.: *E024

BK Resources Model CST-3648HL Dimensions: 34.75(h) x 48(w) x 36(d)
Chef Table, cabinet base with hinged doors & lock, 48"W x 36"D x 34-3/4"H overall size, 14/304 stainless steel top, 18/304 stainless steel body, (1) set of hinged doors with lock, 6" stainless steel legs with 1" height adjustment, stainless steel feet, NSF (3-10 day lead time)

25 kt Model 3SBR-BKDC-4 Caster Kit, includes (4) 3" diameter casters, fits any cabinet base work table, non-marking polyurethane tread, (2) casters come with top lock brake, (2) casters come without brakes, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180°F, zinc plated

ITEM A17 - COUNTERTOP INDUCTION RANGE (26 REQ'D)
SIS No.: *E024

Globe (Middleby) Model GIR18 Dimensions: 6(h) x 15(w) x 19(d)
(QUICK SHIP) (MIDDLEBY ESSENTIALS ITEM) Induction Range, countertop, electric, for continuous use, 140° to 460°F temperature range, (7) power levels, touch pad controls, 4-digit LED display, error code alert display, digital timer, automatic safety shut off, stainless steel construction, ceramic glass surface, 5-1/2 foot power cord, cETLus, ETL-Sanitation, FCC (Ships within 1-2 days)

26 ea	Quick Ship items have limited configurations & that standard configuration may not apply. Contact factory for details
26 ea	1 year parts & labor warranty (excludes wear/expendable parts), standard
26 ea	120v/60/1-ph., 15 amps, 1800 watts, NEMA 5-15P, US

ITEM A18 - 36"W GAS RANGE W/ OVEN BASE (5 REQ'D)
SIS No.: *E024

Turbo Air Model TAR-6 Dimensions: 56.5(h) x 36(w) x 32(d)
Radiance Restaurant Range, gas, 36", (6) 32,000 BTU/hr each lift-off top open burners, (1) standard oven with (1) rack, stainless steel front, sides & back riser lift-off high shelf, full stainless steel oven interior, adjustable oven thermostat, 26.3" D standard, 6" stainless steel adjustable legs standard, regulator included, total 227,000 BTU, CSA, CSA-Sanitation

5 ea	Note: Contact factory representative for parts & accessories discounts
5 ea	1 year labor & parts warranty, standard
5 ea	Natural gas
10 ea	Model RCP1111 Caster, 5", without brake, for Radiance Range (each)
10 ea	Model RCP1112 Caster, 5", with brake, for Radiance Range (each)
5 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
5 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM A19 - MOBILE WORK TABLE (1 REQ'D)
SIS No.: *E024

BK Resources Model CVT-6036 Dimensions: 34.75(h) x 60(w) x 36(d)
Work Table, 60"W x 36"D x 34-3/4"H, 16/304 stainless steel top reinforced with (3) 2" rectangular steel tubing, adjustable stainless steel undershelf, 1-5/8" dia. stainless steel legs & adjustable bullet feet, NSF

1 kt	Model 5SBR-RA-PLY-PS4 Caster Kit, work table 5" diameter expanding stem, fits 1-5/8" OD tubing, non-marking polyurethane tread, top lock brake, 300 lb. capacity, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180° F, zinc plated, POP box, NSF (4 per kit)

ITEM A20 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Length (In): 84
Hood Width (In): 60
Hood Height (In): 24
Style of Hood: Island Unit
Hood Material: All 300 Stainless
Light Options: LED

Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 288

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM A20.1 - MAKE UP AIR DIFFUSER (4 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to A20 for specifications.

ITEM A20.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to A20 for specifications.

ITEM A20.3 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM A20.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # A20

ITEM A20.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # A20.4

ITEM A21 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024
John Boos Model ST6R5-30120SSK Dimensions: 40.75(h) x 120(w) x 30(d)

Work Table, 120"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea	Model X-0115Y Modified as noted, PER SKETCH (for special notations) PARTIAL UNDERSHELF
1 ea	Model X-2201J 30" left end splash, stainless steel (up to 5" in height)
2 ea	Model CUT2020126 Weld-In Undermount Sink, 1-compartment, 20"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
2 ea	Model X-0005A Centered (modification)
2 ea	Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)
2 ea	Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-1OV straight handle lever waste.
1 ea	Note: Provisions made at factory for installation.
2 ea	Model X-0414C Over flow hole, rear centered (modification)

ITEM A21.1 - WELDED-IN S/S SINK (20" X 20" X 12") (2 REQ'D) <Included>
SIS No.: *E024

John Boos Model CUT2020126 Dimensions: 12(h) x 20(w) x 20(d)
Weld-In Undermount Sink, 1-compartment, 20"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM A21.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8DLX16
Equip Faucet, 8" centers, deck mount, 16" swing nozzle, quarter-turn ceramic cartridge, 2" flange, low-lead, ADA Compliant

ITEM A22 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6R5-30108SSK Dimensions: 40.75(h) x 108(w) x 30(d)
Work Table, 108"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea	Model X-2201I 30" right end splash, stainless steel (up to 5" in height)
1 ea	Modify side splash to length of column only
1 ea	Model CUT1620146 Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
1 ea	Model X-0205A On the left (modification)
1 ea	Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)
1 ea	Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-1OV straight handle lever waste.
1 ea	Note: Provisions made at factory for installation.

1 ea Model X-0414C Over flow hole, rear centered (modification)

ITEM A22.1 - WELD-IN S/S RINSE SINK (16" X 20" X 14") (1 REQ'D) <Included>
SIS No.: *E024

John Boos Model CUT1620146 Dimensions: 14(h) x 16(w) x 20(d)
Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM A22.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-1123-CR
Faucet Workboard, swivel, deck mount, 12" long, standard, 8" centers, lever handles, cerama cartridges, check valves, includes: lock washer (014200-45), 2.2 GPM aerator, low-lead, polished chrome, 1/2" male NPT, ADA Compliant, ANSI, NSF

ITEM A23 - 3-COMPARTMENT SINK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKS-3-1824-14-24TS Dimensions: 43.75(h) x 102(w) x 29.81(d)
Sink, three compartment, 102"W x 29-13/16"D x 43-3/4"H overall size, 18” wide x 24” front-to-back x 14" deep compartments, (2) left & right 24" drainboards, 9"H backsplash, 8" OC splash mount faucet holes, 1-1/2" rolled edges on front & sides, includes basket drains (BKDR-4), 18/304 stainless steel construction, stainless steel legs & side bracing, adjustable stainless steel over plastic bullet feet, NSF
3 ea Model BK-LWR-1O Twist Lever Drain, with overflow, fits 3-1/2" opening, 2" male & 1-1/2" female NPT drain outlet, brass construction with stainless steel strainer
3 ea Model BK-LDB Lever Drain Bracket, fits twist drains

ITEM A23.1 - SPLASH-MOUNTED PRE-RINSE FAUCET (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-0133-12ACBJST Dimensions: 39.5(h)
Pre-Rinse Unit, with add-on faucet, splash/wall mount, 8" OC, 44" flexible stainless steel hose with B-0107-J-SMV spray valve, 18" riser, add-on faucet with 12" swing spout (includes 2.2 gpm VR aerator), lever handles, Cerama cartridges with check valves, 6" wall bracket, accessory fitting tee & pre-rinse swivel, low lead

ITEM A23.2 - SPLASH-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8WLX14
Equip Faucet, 8" centers, wall mount, 14" swivel nozzle, 2" flange, ceramic cartridges, low lead, ADA Compliant

ITEM A24 - WALL SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1224 Dimensions: 8(h) x 24(w) x 12(d)
Premium Shelf, wall-mounted, 24"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, NSF

ITEM A25 - WALL SHELF W/ POT RACK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1260-PR Dimensions: 8(h) x 60(w) x 12(d)
Premium Overshelf, wall mount with pot rack, 60"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, (5) stainless steel double prong hooks (BKSSDPH), NSF

ITEM A26 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6R5-30120SSK Dimensions: 40.75(h) x 120(w) x 30(d)
Work Table, 120"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea	Model X-2201I 30" right end splash, stainless steel (up to 5" in height)
2 ea	Model CUT2020126 Weld-In Undermount Sink, 1-compartment, 20"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
2 ea	Model X-0005A Centered (modification)
2 ea	Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)
2 ea	Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-1OV straight handle lever waste.
1 ea	Note: Provisions made at factory for installation.
2 ea	Model X-0414C Over flow hole, rear centered (modification)

ITEM A26.1 - WELDED-IN S/S SINK (20" X 20" X 12") (2 REQ'D) <Included>
SIS No.: *E024

John Boos Model CUT2020126 Dimensions: 12(h) x 20(w) x 20(d)
Weld-In Undermount Sink, 1-compartment, 20"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM A26.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8DLX16
Equip Faucet, 8" centers, deck mount, 16" swing nozzle, quarter-turn ceramic cartridge, 2" flange, low-lead, ADA Compliant

ITEM A27 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM A28 - SPARE NO. <Spare No.>

SIS No.: *E024

ITEM A29 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM A30 - EXHAUST FAN (1 REQ'D) <By HVACC>
SIS No.: *E024

Captive-Aire Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM A30.1 - (LOT) EXHAUST AIR DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM A31 - MAKE UP AIR FAN (1 REQ'D) <By HVACC>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM A31.1 - (LOT) EXHAUST AIR DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM A32 - FAN CONTROL SYSTEM (DEMAND CONTROL VENTILATION) (1 REQ'D)
SIS No.: *E024

Halton Model M.A.R.V.E.L. BASIC 2
For Items # A01, A13, A14, A15, & A20

Hood Qty: 12
ABD Damper Qty: 22
Control Panel w/ Touch Screen: 1
BacNet: IP
Bac Net Qty: 1
Grease Sensor Qty: 2
VFD Qty (10 HP): 1
VFD Cabinet: 1

ITEM A32.1 - SPARE NO. <Spare No.>
SIS No.: *E024
ITEM A32.2 - WALL-MOUNTED ROOM TEMPERATURE SENSOR (1 REQ'D) <Included>
SIS No.: *E024

Halton Model TO BE DETERMINED
Part Of Item #A32 (Fan Control System)

ITEM A33 - WALL-MOUNTED DIGITAL DISPLAY MONITOR (2 REQ'D) <By G/C>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
Part Of Item #A32

ITEM B01 - WALL-MOUNTED S/S HAND SINK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM B01.1 - WALL-MOUNTED SOAP DISPENSER (1 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM B01.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (1 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM B02 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Qty: 2
Hood Length (In): 120
Hood Width (In): 54
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 456
Supply Plenum: Yes
Internal End Cutouts: 2

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters

93-98% Efficient on Particulate in the 5-10 Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller sections to accommodate job site conditions there will be additional charges added per section of hood.

ITEM B02.1 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM B02.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B02 for Specifications

ITEM B02.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B02 for Specifications

ITEM B02.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # B02

ITEM B02.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # B02.5

ITEM B03 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Qty: 2
Hood Length (In): 120
Hood Width (In): 60
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18

Ceiling Closure Length (In): 480

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM B03.1 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM B03.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B03 for Specifications

ITEM B03.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B03 for Specifications

ITEM B03.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # B03

ITEM B03.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # B03.4

ITEM B04 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Qty: 2
Hood Length (In): 120
Hood Width (In): 54
Hood Height (In): 24
Style of Hood: Wall Unit

Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 456

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM B04.1 - MAKE UP AIR DIFFUSER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to Item B04 for Specifications

ITEM B04.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B04 for Specifications

ITEM B04.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B04 for Specifications

ITEM B04.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # B04

ITEM B04.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # B04.5

ITEM B05 - MOBILE COUNTER (12 REQ'D)
SIS No.: *E024

BK Resources Model CST-3648HL Dimensions: 34.75(h) x 48(w) x 36(d)
Chef Table, cabinet base with hinged doors & lock, 48"W x 36"D x 34-3/4"H overall size, 14/304 stainless steel top, 18/304 stainless steel body, (1) set of hinged doors with lock, 6" stainless steel legs with 1" height adjustment, stainless steel feet, NSF (3-10 day lead time)

12 kt Model 3SBR-BKDC-4 Caster Kit, includes (4) 3" diameter casters, fits any cabinet base work table, non-marking polyurethane tread, (2) casters come with top lock brake, (2) casters come without brakes, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180°F, zinc plated

ITEM B06 - COUNTERTOP INDUCTION RANGE (14 REQ'D)
SIS No.: *E024

Globe (Middleby) Model GIR18 Dimensions: 6(h) x 15(w) x 19(d)
(QUICK SHIP) (MIDDLEBY ESSENTIALS ITEM) Induction Range, countertop, electric, for continuous use, 140° to 460°F temperature range, (7) power levels, touch pad controls, 4-digit LED display, error code alert display, digital timer, automatic safety shut off, stainless steel construction, ceramic glass surface, 5-1/2 foot power cord, cETLus, ETL-Sanitation, FCC (Ships within 1-2 days)

14 ea Quick Ship items have limited configurations & that standard configuration may not apply. Contact factory for details

14 ea 1 year parts & labor warranty (excludes wear/expendable parts), standard

14 ea 120v/60/1-ph., 15 amps, 1800 watts, NEMA 5-15P, US

ITEM B07 - MOBILE WORK TABLE (2 REQ'D)
SIS No.: *E024

BK Resources Model CVT-6036 Dimensions: 34.75(h) x 60(w) x 36(d)
Work Table, 60"W x 36"D x 34-3/4"H, 16/304 stainless steel top reinforced with (3) 2" rectangular steel tubing, adjustable stainless steel undershelf, 1-5/8" dia. stainless steel legs & adjustable bullet feet, NSF

2 kt Model 5SBR-RA-PLY-PS4 Caster Kit, work table 5" diameter expanding stem, fits 1-5/8" OD tubing, non-marking polyurethane tread, top lock brake, 300 lb. capacity, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180° F, zinc plated, POP box, NSF (4 per kit)

ITEM B08 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6R5-3072SSK Dimensions: 40.75(h) x 72(w) x 30(d)
Work Table, 72"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea Model CUT1620146 Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

1 ea Model X-0205A On the left (modification)

1 ea Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)

1 ea	Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-1OV straight handle lever waste.
1 ea	Note: Provisions made at factory for installation.
1 ea	Model X-0414C Over flow hole, rear centered (modification)
1 ea	Model DR2020-S30 Drawer, for 30"D work tables, 20"W x 20" front-to-back x 5" deep, stainless steel front & drawer pan, roller bearing slides, NSF, for stainless steel table tops only
1 ea	Model X-0205B On the right (modification)

ITEM B08.1 - WELD-IN S/S RINSE SINK (16" X 20" X 14") (1 REQ'D) <Included>
SIS No.: *E024

John Boos Model CUT1620146 Dimensions: 14(h) x 16(w) x 20(d)
Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM B08.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-1123-CR
Faucet Workboard, swivel, deck mount, 12" long, standard, 8" centers, lever handles, cerama cartridges, check valves, includes: lock washer (014200-45), 2.2 GPM aerator, low-lead, polished chrome, 1/2" male NPT, ADA Compliant, ANSI, NSF

ITEM B09 - WALL-MOUNTED DIGITAL DISPLAY MONITOR (1 REQ'D) <By G/C>
SIS No.: *E024

Custom Model NEWLINE TT-8623QA
This is not in the Foodservice Equipment Scope
Supplied by Owner, Installed by GC

ITEM B10 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVW
Hood Qty: 1
Hood Length (In): 144
Hood Width (In): 84
Hood Height (In): 24
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 456

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10

Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller sections to accommodate job site conditions there will be additional charges added per section of hood.

ITEM B10.1 - MAKE UP AIR DIFFUSER (4 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to Item B10 for Specifications

ITEM B10.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item B10 for Specifications

ITEM B10.3 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM B10.4 - WALL-MOUNTED MANUAL HOOD FILTER REMOVAL TOOL (1 REQ'D) <Included>
SIS No.: *E024

Halton Model TO BE DETERMINED
Refer to Item B10 for Specifications

ITEM B10.5 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # B10

ITEM B10.6 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # B10.6

ITEM B11 - WALK-IN COOLER (1 REQ'D)
SIS No.: *E024

AmeriKooler Model CUSTOM
Description: Compartment 2 of 2 - Indoor Cooler, with Floor
Interior Dim: 8'-6" x 12'-3" x 8'-8 5/8" (w x l x h)

Temperature: 35°F (95°F ambient)
Insulation: 4" thick AK-XPS4 extruded foam with R-values of R-29 for coolers and R-32 for freezers with a 50 Year Thermal Warranty.
UL Classified Core Flame Spread 15, Smoke Rating less than 165.
Warranty: 15 Year Panel Warranty and 1 Year Parts Warranty
Finishes: Interior walls: 26 Ga. Stucco Galvanized White
Exterior walls: 26 Ga. Stucco Embossed Acrylume
Interior ceiling: 26 Ga. Stucco Galvanized White
Exterior ceiling: 26 Ga. Stucco Embossed Acrylume
Floor Type: Type F1-22S
Application: Foot Traffic - No Rolling Carts
NSF Floor panel rated for 700 LBS/ SQ. FT.
22 Ga. Stainless Steel Integral - Not Reinforced
Door: (1) Standard 36" x 76" Left hinged flush door with brushed hardware. Interior finish: 26 Ga. Stucco Galvanized White, Exterior finish: 26
Ga. Stucco Embossed Acrylume.36" kickplates to interior and
exterior of door. Heavy duty deadbolt handle latch with 1/4 turn
inside release. 75LC Modularm Multi-Monitor Controller with
Temparature Probe and Door Open/Close Sensor for Coolers or
Freezers Wired and Installed with MD-1 Motion sensor, IP-1 Panic
button/light. 1807 11w, Vapor Proof, 120V. LED fixture. 82 Lumens
/watt Angled face . Requires 115vac. 1 amps.
With third hinge, 12 x 12 heated frame & glass viewing window
Accessories: (2) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33
AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED
ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH
Equipment: Refrigeration Supplied By Others
Recommended minimum duty 8081 Btu/hr at 95°F ambient
Freight Freight included to NY 10994
Truckload: TMS Q070220241K

ITEM B11.1 - STRIP CURTAINS (1 REQ'D)
SIS No.: *E024

HIMI Products Model FC1000
Height (in.) 84
Temperature Range -10 F to 180 F
Anti-discoloration uv treatment
Velco-attached strip system
Double layered strips
Textured clear polyvinyl anti-stick strips
3" strips
Polyvinyl chloride (PVC) material
-10 to 180 degrees fahrenheit temperature range
Dishwasher safe
Convenient mounting system with header (all hardware included)
Decreases cooling equipment run time
Easy to remove strips
97% overlap
Made in USA

ITEM B11.2 - (LOT) S/S LOUVERED CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

AmeriKooler Model CUSTOM
Refer to Item B11 for Specifications

ITEM B11.3 - COOLER EVAPORATOR COIL (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CL6A094ADA
Refrig-448A
H.P. 1-1/4
Condensing Unit Model - CFO150E4SEA
Coldzone Evaporator Coils - Model # CL6A094ADA

• ALL EVAPORATOR COILS WILL REQUIRE POWER FROM A HOUSE CIRCUIT UNLESS OTHERWISE STATED
• EVAPORATOR WITH THERMAL EXPANSION VALVE, LIQUID LINE SOLENOID, AND ELECTRONIC ROOM THERMOSTAT
• ALL COMPRESSORS AND CONDENSER CIRCUITS ARE SIZED TO OPERATE AT 95°F AMBIENT
• LIQUID LINE KIT WITH SEALED FILTER/DRIER AND SIGHT GLASS WITH MOISTURE INDICATOR
• EACH SYSTEM SUPPLIED WITH SUCTION LINE KIT INCLUDING A SUCTION LINE FILTER
• EXTERNAL MOUNTED FUSED DISCONNECT
• SYSTEMS WITH HEATED/INSULATED RECEIVERS FOR LOW AMBIENT OPERATION
• FREEZER CONDENSING UNIT(S) WITH SUCTION ACCUMULATOR
• CONDENSING UNITS DO NOT INCLUDE CIRCUIT BREAKERS FOR COMPRESSOR CONTACTOR OR CONTROL CIRCUIT

ITEM B11.4 - COMPRESSOR (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CFO130E4SEA
Install & Mount In Curb by HVAC

ITEM B12 - WALK-IN FREEZER (1 REQ'D) <Included>
SIS No.: *E024

AmeriKooler Model CUSTOM
Description: Compartment 1 of 2 - Indoor Freezer, with Floor
Interior Dim: 8'-6" x 12'-3" x 8'-8 5/8" (w x l x h)
Temperature: -10°F (95°F ambient)
Insulation: 4" thick AK-XPS4 extruded foam with R-values of R-29 for coolers and R-32 for freezers with a 50 Year Thermal Warranty.
UL Classified Core Flame Spread 15, Smoke Rating less than 165.
Warranty: 15 Year Panel Warranty and 1 Year Parts Warranty
Finishes: Interior walls: 26 Ga. Stucco Galvanized White
Exterior walls: 26 Ga. Stucco Embossed Acrylume
Interior ceiling: 26 Ga. Stucco Galvanized White
Exterior ceiling: 26 Ga. Stucco Embossed Acrylume Floor Type: Type F1-22S
Application: Foot Traffic - No Rolling Carts
NSF Floor panel rated for 700 LBS/ SQ. FT.
22 Ga. Stainless Steel Integral - Not Reinforced
Door: (1) Non-Standard 36" x 78" Left hinged flush door with brushed hardware. Interior & Exterior finish: 26 Ga. Stucco Galvanized White.

36" kickplates to interior and exterior of door. Energy saving temperature regulating thermostat heater wire and heated relief
vent. Heavy duty deadbolt handle latch with 1/4 turn inside release.
75LC Modularm Multi-Monitor Controller with Temparature Probe
and Door Open/Close Sensor for Coolers or Freezers Wired and
Installed with MD-1 Motion sensor, IP-1 Panic button/light. 1807
11w, Vapor Proof, 120V. LED fixture. 82 Lumens /watt Angled face .
Requires 115vac. 2.2 amps.
With third hinge, 12 x 12 heated frame & glass viewing window
Accessories: (2) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33
AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED
ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH
Equipment: Refrigeration Supplied By Others
Recommended minimum duty 8953 Btu/hr at 95°F ambient
Accessories: (1) CLOSURE PANEL 26 GA. STUCCO EMBOSSED ACRYLUME 27" X 36"
FOR INDOOR BOXES AGAINST BUILDING STRUCTURE
(1) CLOSURE PANEL 26 GA. STUCCO EMBOSSED ACRYLUME 77" X 36"
FOR INDOOR BOXES AGAINST BUILDING STRUCTURE
(2) EXTERIOR TRIM 3" X 3" X 108" FOR INDOOR BOXES AGAINST
BUILDING STRUCTURE
(1) INVERTED L SHAPE EXTERIOR WALL CORNER WITH FLOOR EACH

ITEM B12.1 - STRIP CURTAINS (1 REQ'D)
SIS No.: *E024

HIMI Products Model FC1000
Height (in.) 84
Temperature Range -10 F to 180 F
Anti-discoloration uv treatment
Velco-attached strip system
Double layered strips
Textured clear polyvinyl anti-stick strips
3" strips
Polyvinyl chloride (PVC) material
-10 to 180 degrees fahrenheit temperature range
Dishwasher safe
Convenient mounting system with header (all hardware included)
Decreases cooling equipment run time
Easy to remove strips
97% overlap
Made in USA

ITEM B12.2 - FREEZER EVAPORATOR COIL (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CL6E105DDA
Refrig-448A
H.P. 3-1/2
Condensing Unit Model - CFO350L4SEA
Coldzone Evaporator Coils - Model # CL6E105DDA

• ALL EVAPORATOR COILS WILL REQUIRE POWER FROM A HOUSE CIRCUIT UNLESS OTHERWISE STATED

• EVAPORATOR WITH THERMAL EXPANSION VALVE, LIQUID LINE SOLENOID, AND ELECTRONIC ROOM THERMOSTAT
• ALL COMPRESSORS AND CONDENSER CIRCUITS ARE SIZED TO OPERATE AT 95°F AMBIENT
• LIQUID LINE KIT WITH SEALED FILTER/DRIER AND SIGHT GLASS WITH MOISTURE INDICATOR
• EACH SYSTEM SUPPLIED WITH SUCTION LINE KIT INCLUDING A SUCTION LINE FILTER
• EXTERNAL MOUNTED FUSED DISCONNECT
• SYSTEMS WITH HEATED/INSULATED RECEIVERS FOR LOW AMBIENT OPERATION
• FREEZER CONDENSING UNIT(S) WITH SUCTION ACCUMULATOR
• CONDENSING UNITS DO NOT INCLUDE CIRCUIT BREAKERS FOR COMPRESSOR CONTACTOR OR CONTROL CIRCUIT

ITEM B12.3 - DRAIN LINE HEATER (1 REQ'D) <Included>
SIS No.: *E024

Custom Model CUSTOM
Installed By Refrigeration Contractor

ITEM B12.4 - COMPRESSOR (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CFO300L4SEA
Install & Mount In Curb by HVAC

ITEM B13 - REACH-IN REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MBF8005GR Dimensions: 81.3(h) x 51.7(w) x 31.7(d)
Atosa Refrigerator, reach-in, two-section, 51-7/10"W x 31-7/10"D x 81-3/10"H, top mount self-contained refrigeration, 43.2 cu. ft. (2) locking hinged solid doors, digital temperature control, 33° to 40°F temperature range, (6) adjustable shelves, interior LED lighting, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 4" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.2 amps, cord with NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®
1 ea 2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM B14 - BUG LIGHT (1 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM B15 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM B16 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM B17 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM B18 - EXHAUST FAN (1 REQ'D) <By HVACC>
SIS No.: *E024

Captive-Aire Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM B18.1 - (LOT) EXHAUST AIR DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM B19 - MAKE UP AIR FAN (1 REQ'D) <By HVACC>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM B19.1 - (LOT) EXHAUST AIR DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM B20 - FAN CONTROL SYSTEM (DEMAND CONTROL VENTILATION) (1 REQ'D)
SIS No.: *E024

Halton Model M.A.R.V.E.L. BASIC 2
For Items # B03, B04, B05, B10, C02, C17

Hood Qty: 10
ABD Damper Qty: 10
Control Panel w/ Touch Screen: 1
BacNet: IP
Bac Net Qty: 1
Grease Sensor Qty: 2
VFD Qty (10 HP): 1
VFD Cabinet: 1
Start-Up Marvel Hood Qty: 10

ITEM B20.1 - WALL-MOUNTED ROOM TEMPERATURE SENSOR (1 REQ'D) <Included>
SIS No.: *E024

Halton Model TO BE DETERMINED
Part Of Item #B21 (Fan Control System)

ITEM B20.2 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM C01 - WALL-MOUNTED S/S HAND SINK (2 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM C01.1 - WALL-MOUNTED SOAP DISPENSER (2 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM C01.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (2 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM C02 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Qty: 2
Hood Length (In): 112
Hood Width (In): 66
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 356
Internal End Cutouts: 2

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions

there will be additional charges added per
section of hood.

ITEM C02.1 - MAKE UP AIR DIFFUSER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to Item C02 for Specifications

ITEM C02.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item C02 for Specifications

ITEM C02.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item C02 for Specifications

ITEM C02.4 - S/S WALL PANELS (1 REQ'D) <Included>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
Refer to Item C02 for Specifications

ITEM C02.5 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # C02

ITEM C02.6 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # C02.6

ITEM C03 - DOUBLE-STACK GAS COMBI OVEN (1 REQ'D)
SIS No.: *E024

RATIONAL Model ICP 6-FULL ON 6-FULL NG 208/240V 1 PH
Two (2) (CC1GRRA.0000238) iCombi Pro® 6-Full Size Combi Ovens, double stack, natural gas, (12) 18" x 26" sheet pan or (24) 12" x 20" steam pan or (12) 2/1 GN pan capacity, (6) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite,

iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 106,500 BTU each, 208/240v/60Hz/1-ph, 6 ft. cord, 0.9 kW each, CE, IPX5, cCSAus, NSF, ENERGY STAR-®

1 kt	Model 60.75.752 Combi-Duo Universal Stacking Kit, for iCombi 6-half size or 6-full size (electric or gas) on iCombi 6-full size (gas only)
1 ea	Model 60.31.204 Stand I for Combi-Duo, mobile, 7-3/4"H, all sides open, stainless steel construction, height adjustable casters, for iCombi 6-full size on 6-full size
1 ea	Model 87.00.732US Safety-Set, Equipment placement system for all casters-mounted equipment, allows precise, consistent equipment placement for drain lines to floor sinks and under the fire suppression in ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes tow (2) pieces and installation pack. THIS ITEM IS NON_DISCOUNTABLE (NET)
1 ea	NOTE: All discounts subject to approval by manufacturer
1 ea	2 years parts and labor, 5 years steam generator warranty
2 ea	Model 9999.9613 K-12 Extended Warranty: Extends the warranty for 12 months beyond the Original Equipment Warranty to 3 years parts and labor. (NET)
1 ea	Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
1 ea	Model 9999.2002 Pre-Installation Site Consultation, provides an installation consultation to ensure the site has proper space and connections for gas, electric, drain & water, one (1) Consultation is needed for every four (4) cooking systems, add ‘in one (1) kitchen’, includes 100 miles (200 miles round trip). (see attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
2 ea	Model 9999.2252 RCI RATIONAL Certified Installation, new certified installation for each table-top iCombi of a combi-duo, 100 miles (200 round-trip) included. (See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
1 ea	Model 9999.2003 Second Installation Trip – only with RATIONAL Certified Installation when separate dates are required. Includes up to 4 cooking systems in one kitchen. Includes 100 miles (200 miles round-trip). THIS ITEM IN NON-DISCOUNTABLE, USA ONLY (NET)
2 ea	Model 8720.1560US Installation Kit, for gas iCombi/SCC/CMP 101G (120/60Hz/1ph); gas iCombi/SCC/CMP 62G (208-240/60Hz/1ph); gas iCombi/SCC/CMP 61G (120/60Hz/1ph) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
1 ea	Model 1900.1158US Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
1 ea	Model 9999.2271 RCI RATIONAL Certified Installation, additional installation cost for a RATIONAL Water Filter System is available when purchased with Certified Installation of RATIONAL unit THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
1 ea	Note: The RATIONAL Water Filtration Systems helps provide consistent high-quality water to your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines, and chlorine while delivering the required flow rates.
1 ea	NOTE: All public water systems using surface water and most ground water systems treat with either chlorine/chloramine or chlorine dioxide (EPA will allow levels as high as 4ppm safe for drinking water, exceeding our maximum level of .2ppm.
1 ea	NOTE: Chloride concentrations above 80ppm can cause corrision. RATIONAL Water Filtration does NOT reduce chloride
1 ea	Free Water Testing Kits are available (contact factory for info)
2 ea	Model 1900.1155US Water Filtration Cartridge, replacement or add on with additional Modular Head to Double Cartridge System, includes: (1) R95-CLX filter
1 ea	Model 56.01.535 Active Green Cleaner Tabs, for all iCombi Pro/Classic, 150 pieces/bucket (minimum order quantity- 2 ea, unless ordered with a unit) (NET)

1 ea Model 56.00.562 Care Tabs, bucket of 150 packets for all iCombi Pro/Classic models and SelfCooking Center® units from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity: 2pcs, unless ordered with a unit) (NET)
2 ea Model 60.75.768 Heat Shield, for right side panel, type 6-full size Pro/Classic, 2"W, stainless steel construction
2 kt BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
2 ea BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM C03.1 - ADDITIONAL UTILITY INFORMATION FOR TOP (1 REQ'D) <Included>
SIS No.: *E024

RATIONAL Model CUSTOM
Refer to Item C03 for specifications

ITEM C03.2 - WATER FILTER (1 REQ'D) <Included>
SIS No.: *E024

RATIONAL Model 1900.1158US Dimensions: 24.63(h) x 18.5(w) x 5.38(d)
Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
1 ea NOTE: The RATIONAL Water Filtration Systems helps provide consistent high quality water to your RATIONAL SelfCooking Center or your CombiMaster Plus. The patented carbon block technology reduces the effects of sediment, chloramines and chlorine while providing the required flow rates

ITEM C04 - 2-BATTERY GAS FRYER W/ FILTRATION SYSTEM (1 REQ'D)
SIS No.: *E024

Imperial (Middleby) Model IFSCB250 Dimensions: 45.75(h) x 46.5(w) x 36.5(d)
Fryer, gas, floor model, (2) battery, 50 lb. capacity each, built-in filter system, 5.5 GPM roller pump, snap action thermostat, drain station, cabinet, includes: food warmer, dump pan, joiner strips & filter start kit, stainless steel frypot, front, sides, landing ledge, & cabinet, casters, 120v/60/1-ph, 6.8 amps, 1/3 HP, 280,000 BTU, CSA Flame, CSA Star, NSF, CE
1 ea Limited one year parts and labor warranty, standard
1 ea Natural gas (must specify elevation if over 2000 ft)
1 ea Manifold gas shut-off valve (3/4" N.P.T.)
1 ea 115v/60/1-ph, 6.8 amps, filter motor voltage, 6 ft. cord with plug
2 ea Stainless steel tank cover, one per vat, one per vat
2 ea Twin baskets (set of 2)
1 kt BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 ea BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM C04.1 - HEAT LAMP (1 REQ'D) <Included>
SIS No.: *E024

Imperial (Middleby)
For Dump Station

ITEM C05 - 36"W COUNTERTOP GAS GRIDDLE (3 REQ'D)
SIS No.: *E024

Imperial (Middleby) Model ITG-36 Dimensions: 14(h) x 36(w) x 32.38(d)
Griddle, countertop, gas, 36"W x 24"D cooking surface, 1" thick polished steel plate, (3) griddle burners, continuous pilot, aeration baffles, thermostatic controls, 4"W grease gutter, removable 1 gallon grease can with weep hole, full width rear flue, stainless steel front, sides, splash guard & ledge, 4" stainless steel legs, 90,000 BTU, 26W, cETLus, NSF, CE

3 ea	Limited one year parts and labor warranty, standard
3 ea	Natural gas (must specify elevation if over 2000 ft)
3 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
3 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM C06 - REFRIGERATED EQUIPMENT STAND (2 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MGF8448GR Dimensions: 26.6(h) x 35.63(w) x 33(d)
Atosa Chef Base, one-section, 35-5/8"W x 33"D x 26-3/5"H, side-mounted self-contained refrigeration, 4.7 cu. ft., (2) self-closing drawers with recessed handles, digital temperature control, 34° to 40°F temperature range, includes (2) 12 x 20 & (6) 1/6 stainless steel pans, stainless steel interior & exterior, 5" casters, R290 Hydrocarbon refrigerant, 1/7 HP, 2.3 amps,115v/60/1-ph, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®

2 ea	2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)
2 ea	1/6 size, 6" deep metal pans and dividers included (see specsheet for exact pans included per model)

ITEM C07 - 36"W GAS RANGE W/ CONVECTION OVEN (2 REQ'D)
SIS No.: *E024

American Range Model AR-6-C Dimensions: 56(h) x 36(w) x 32.25(d)
Restaurant Range, gas, 36", (6) 32,000 BTU open burners, (1) 26-1/2" convection oven, (2) racks, stainless steel front, sides, choice of high shelf and riser, 20" riser or 6" stub back, 6" adjustable chrome plated legs, 65.0kW, 226,000 BTU, cETLus, ETL-Sanitation, Made in USA

2 ea	Standard two year limited warranty on parts & labor
2 ea	Natural Gas
2 ea	20" riser with shelf, stainless-steel
2 st	Model A35117 Casters, set of 4 (2 locking)
2 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)

2 ea BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM C08 - REACH-IN REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MBF8005GR Dimensions: 81.3(h) x 51.7(w) x 31.7(d)
Atosa Refrigerator, reach-in, two-section, 51-7/10"W x 31-7/10"D x 81-3/10"H, top mount self-contained refrigeration, 43.2 cu. ft. (2) locking hinged solid doors, digital temperature control, 33° to 40°F temperature range, (6) adjustable shelves, interior LED lighting, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 4" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.2 amps, cord with NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®
1 ea 2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM C09 - MOBILE HEATED HOLDING CABINET (2 REQ'D)
SIS No.: *E024

Carter-Hoffmann (Middleby) Model HL3-18 Dimensions: 70.63(h) x 26.5(w) x 31.5(d)
hotLOGIX Holding Cabinet-HL3 Series, one compartment, full height, insulated, (36) 12" x 20" or (18) 18" x 26" pan capacity, 3" fixed wire universal slides, (1) single pane tempered glass door, bottom-mount forced air heating system, mechanical controls, digital thermometer, aluminum construction, (4) 5" swivel casters (2 with brakes), cETLus, ETL-Sanitation (RapidShip)
2 ea 3 Year parts & labor warranty, standard
2 ea 120v/60/1-ph, 1750 watts, 15.0 amps, 8 ft cord with NEMA 5-20P, standard
2 ea Single pane tempered glass door in extruded aluminum, standard

ITEM C09.1 - MOBILE HEATED HOLDING CABINET (1 REQ'D)
SIS No.: *E024

Carter-Hoffmann (Middleby) Model HL3-18 Dimensions: 70.63(h) x 26.5(w) x 31.5(d)
hotLOGIX Holding Cabinet-HL3 Series, one compartment, full height, insulated, (36) 12" x 20" or (18) 18" x 26" pan capacity, 3" fixed wire universal slides, (1) single pane tempered glass door, bottom-mount forced air heating system, mechanical controls, digital thermometer, aluminum construction, (4) 5" swivel casters (2 with brakes), cETLus, ETL-Sanitation (RapidShip)
1 ea 3 Year parts & labor warranty, standard
1 ea 120v/60/1-ph, 1750 watts, 15.0 amps, 8 ft cord with NEMA 5-20P, standard
1 ea Single pane tempered glass door in extruded aluminum, standard

ITEM C10 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6-3696SBK Dimensions: 35.75(h) x 96(w) x 36(d)
Work Table, 96"W x 36"D, 16/300 stainless steel flat top, with Stallion Safety Edge front & back, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs, side & rear adjustable bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD

ITEM C10 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

BK Resources Model SVTOB-1836 Dimensions: 36(h) x 36(w) x 18(d)

Work Table, 36"W x 18"D, 18/430 stainless steel top, with turndown edges on all sides, reinforced with channels, open base with stainless steel side & rear bracing, 1-5/8" dia. stainless steel legs, stainless steel over plastic adjustable bullet feet, ships KD, NSF

ITEM C11 - WORKTOP REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MGF8403GR Dimensions: 34.25(h) x 60.25(w) x 30(d)
Atosa Undercounter Refrigerator, reach-in, two-section, 60-1/4"W x 30"D x 34-1/4"H, rear-mounted self-contained refrigeration, 17.2 cu. ft., (2) hinged solid doors, digital temperature control, 33° to 40°F temperature range, (2) adjustable shelves, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 2" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 2.8 amps, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea	2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM C12 - HEAT LAMP (1 REQ'D)
SIS No.: *E024

Hatco Model GRAIH-72 Dimensions: 2.5(h) x 72(w) x 6(d)
Glo-Ray® Infrablack Strip Heater, 72" W, high wattage, metal sheathed heating element, single heater housing, aluminum construction, 1725 watts, NSF, CE, cULus, Made in USA

1 ea	NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
1 ea	NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
1 ea	One year on-site parts & labor warranty, plus one additional year parts only warranty on all Glo-Ray metal sheathed elements
1 ea	120v/60/1-ph
1 ea	Model RMB-3F Remote Control Enclosure, (1) toggle switch, (1) indicator light (for 120 volt only)
1 ea	Model STANDARD Clear Anodized Aluminum housing, standard (available at time of purchase only)
1 ea	Model HTLEADS10 6' - 10' Extended Electrical Leads (available at time of purchase only)
1 ea	Model AIH72WG-1 Element wire guard, single 72" unit (available at time of purchase only)
1 pr	Model ADJ ANGLE Adjustable angle bracket, pair

ITEM C13 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6-3696SSK Dimensions: 35.75(h) x 96(w) x 36(d)
Work Table, 96"W x 36"D, 16/300 stainless steel flat top, with Stallion Safety Edge front & back, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea	Model CUT1620146 Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
1 ea	Model X-0205A On the left (modification)
1 ea	Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)
1 ea	Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-1OV straight handle lever waste.

1 ea Note: Provisions made at factory for installation.
1 ea Model X-0414C Over flow hole, rear centered (modification)
1 ea Model DR2020-S36 Drawer, for 36"D work tables, 20"W x 20" front-to-back x 5" deep, stainless steel front & drawer pan, roller bearing slides, NSF, for stainless steel table tops only
1 ea Model X-0005A Centered (modification)
1 ea Model OSE26FK-1296 Overshelf, double, 96"W x 12"D, 16/300 stainless steel flat top, mounted 18" above table top, 12" between shelves, 1" stainless steel post, KD, NSF
1 ea Model X-2410R Mount overshelf at rear location on table
1 ea Model OSEHLP-696 Heat lamp provision for 96" overshelf
1 pr Model OSHLB-6 Heat Lamp Bracket, 6" wide, comes as a pair, fits with Hatco warming lamps & JBC overshelves
1 ea Model X-2411T Heat lamp provision top shelf

ITEM C13.1 - TABLE-MOUNTED DOUBLE OVERSHELF (1 REQ'D) <Included>
SIS No.: *E024

John Boos Model OSE26FK-1296 Dimensions: 30(h) x 96(w) x 12(d)
Overshelf, double, 96"W x 12"D, 16/300 stainless steel flat top, mounted 18" above table top, 12" between shelves, 1" stainless steel post, KD, NSF
1 ea Model ZZBOOSOSHLFLOCTN Specify overshelf mounting location

ITEM C13.2 - WELD-IN S/S RINSE SINK (16" X 20" X 12") (1 REQ'D)
SIS No.: *E024

BK Resources Model BKFB-1620-12-16 Dimensions: 16(h) x 20(w) x 12(d)
Weld-In Sink, one compartment, 16"W x 20"D x 12" deep, 3/4" covered corners, bottom crowned to 3-1/2" embossed opening, slope drain, interior seams polished, exterior seams unpolished, 16/304 stainless steel construction, NSF C2

ITEM C13.3 - DECK-MOUNTED FAUCET W/ SWING SPOU (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-1123-CR
Faucet Workboard, swivel, deck mount, 12" long, standard, 8" centers, lever handles, cerama cartridges, check valves, includes: lock washer (014200-45), 2.2 GPM aerator, low-lead, polished chrome, 1/2" male NPT, ADA Compliant, ANSI, NSF

ITEM C13.4 - TICKET RAIL (4 REQ'D)
SIS No.: *E024

Admiral Craft Equipment Corp. Model CM-36
Check Minder, 36"L x 3"H, wall mount (predrilled), slide style, aluminum with glass marbles

ITEM C14 - UNDERCOUNTER REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MGF8403GR Dimensions: 34.25(h) x 60.25(w) x 30(d)
Atosa Undercounter Refrigerator, reach-in, two-section, 60-1/4"W x 30"D x 34-1/4"H, rear-mounted self-contained refrigeration, 17.2 cu. ft., (2) hinged solid doors, digital temperature control, 33° to 40°F

temperature range, (2) adjustable shelves, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 2" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 2.8 amps, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®
1 ea 2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM C15 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6-36144SBK Dimensions: 35.75(h) x 144(w) x 36(d)
Work Table, 144"W x 36"D, 16/300 stainless steel flat top, with Stallion Safety Edge front & back, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs, side & rear adjustable bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD
1 ea Model DP2020-S36 Drawer, for 36"D work tables, 20"W x 20"D x 4-3/4" deep, stainless steel construction, poly friction slides, for stainless steel table tops only, NSF
1 ea Model X-0205A On the left (modification)

ITEM C16 - REFRIGERATED PREP TABLE (1 REQ'D)
SIS No.: *E024

Hoshizaki Model SR36B-15M Dimensions: 44.25(h) x 36(w) x 37.3(d)
Steelheart Series Mega Top Refrigerator, reach-in, single section, 36"W, 9.9 cu. ft., self-contained rear mounted refrigeration system, (1) solid hinged door, (1) adjustable shelf, provided with (15) 1/6 pans 4" deep, 10" D x 1/2" thick white polyethylene cutting board & a full set of adapter bars, stainless steel interior, stainless steel exterior front, sides & top, (4) 6" casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/6 HP, NEMA 5-15P, cETLus, ETL-Sanitation
1 ea Warranty: 7-Year labor on entire machine
1 ea Warranty: 7-Year parts on entire machine
1 ea Warranty: 7-Year parts on compressor
1 ea 115v/60/1-ph, 2.7 amps, standard
1 ea Model HS-5279 Stainless Steel Lift-Off Cover, flat, for 15-pan Mega Top opening

ITEM C17 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVW
Hood Qty: 1
Hood Length (In): 142
Hood Width (In): 60
Hood Height (In): 24
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 404

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool

If the hoods have to be broken into smaller sections to accommodate job site conditions there will be additional charges added per section of hood.

ITEM C17.1 - MAKE UP AIR DIFFUSER (4 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to Item C17 for Specifications

ITEM C17.2 - (LOT) S/S VERTICAL CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to Item C17 for Specifications

ITEM C17.3 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM C17.4 - WALL-MOUNTED FIRE SUPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Item # C17

ITEM C17.5 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
For Item # C17.4

ITEM C18 - REFRIGERATED EQUIPMENT STAND (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MGF8452GR Dimensions: 26.6(h) x 60.5(w) x 33(d)
Atosa Chef Base with Extended Top, one-section, 60-1/2"W x 33"D x 26-3/5"H, side-mounted self-contained refrigeration, 8.4 cu. ft., (2) self-closing drawers with recessed handles, digital temperature control, 34° to 40°F temperature range, includes (6) 12 x 20 stainless steel pans, stainless steel interior & exterior, 5" casters, R290 Hydrocarbon refrigerant, 1/7 HP, 2.3 amps,115v/60/1-ph, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea	2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)
1 ea	1/6 size, 6" deep metal pans and dividers included (see specsheet for exact pans included per model)

ITEM C19 - 24"W COUNTERTOP GAS CHARBROILER (1 REQ'D)
SIS No.: *E024

Turbo Air Model TARB-24 Dimensions: 10(h) x 24(w) x 30(d)
Radiance Charbroiler, countertop, gas, 24" wide, 16 ga. stainless steel front plate & wrap, heavy duty cast iron radiant & grate, (4) burners with manual controls, removable grease pan, bullnose stainless steel front extension, heat resistant on-off knob, 2" stainless steel standard legs, regulator included, total 60,000 BTU, CSA, CSA-Sanitation

1 ea Note: Contact factory representative for parts & accessories discounts
1 ea 1 year labor & parts warranty, standard
1 ea Natural gas
1 ea Model RCP1002 Regulator, Natural Gas / LP Gas Convertible

ITEM C20 - COUNTERTOP DUMP STATION (1 REQ'D)
SIS No.: *E024

Hatco Model GRFFB Dimensions: 20(h) x 12.75(w) x 24(d)
Glo-Ray® Portable Strip Heater, with metal sheathed element, heats from above & below, with pre-set heated base, 750 watts, 6.3 amps, NSF, cULus, Made in USA

1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Glo-Ray metal sheathed elements
1 ea 120v/60/1-ph, 750 watts, 6.3 amps, NEMA 5-15P (domestic voltage)
1 ea 14" Clearance, 18" Over All Height
1 ea Toggle switch standard
1 ea Model STANDARD Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

ITEM C21 - GAS FRYER (1 REQ'D)
SIS No.: *E024

Imperial (Middleby) Model IFS-40 Dimensions: 45.75(h) x 15.5(w) x 30.5(d)
(QUICK SHIP) Fryer, gas, floor model, 40 lb. capacity, tube fired cast iron burners, snap action thermostat, millivolt temperature control, includes: wire mesh crumb screen & (2) nickel-plated baskets, stainless steel front, door, sides, basket hanger & frypot, 6" legs, 105,000 BTU, CSA Flame, CSA Star, NSF, CE (Ships within 1-2 days)

1 ea Quick Ship items have limited configurations & that standard configuration may not apply. Contact factory for details
1 ea Limited one year parts and labor warranty, standard
1 ea Natural gas (must specify elevation if over 2000 ft)
1 ea Quick disconnect & flex hose with restraining device, 3/4" N.P.T. x 48"
1 ea Stainless steel tank cover, one per vat, one per vat
1 ea Swivel casters (set of 4) two with brakes, per set

ITEM C22 - UNDERCOUNTER FREEZER (1 REQ'D)
SIS No.: *E024

Hoshizaki Model EUF27A Dimensions: 33.75(h) x 27(w) x 31.25(d)
Economy Series Undercounter Freezer, reach-in, one-section, 27"W, 6.33 cu. ft., self-contained rear mounted refrigeration system, (1) solid hinged door, (1) adjustable shelf, stainless steel interior floor with

aluminum front, sides, & top, stainless steel exterior front, sides & top, (4) 4" casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/5 HP, NEMA 5-15P, cULus, UL EPH Classified, ENERGY STAR®

1 ea Warranty: 2-Year parts & labor on entire machine
1 ea Warranty: 5-Year parts on compressor
1 ea 115v/60/1-ph, 1.2 amps, standard

ITEM C23 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model CUSTOM
36x156 w/ 78" Partial Undershelf

1 ea Model X-0115Y Modified as noted, PER SKETCH (for special notations)
W/ 78" PARTIAL UNDERSHELF
2 ea Model CUT2424146 Weld-In Undermount Sink, 1-compartment, 24"W x 24" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
1 ea Model PBF-8HD-8-SLF Heavy Duty Faucet, deck mount, 8" swing spout, 8" centers, 1/4 turn ceramic cartridges, color coded hot/cold indicators, integral check valve, 1/2" NPT, chrome finish, NSF, cCSAus, ADA Compliant (LEAD FREE FAUCET)
1 kt Model PB-DMMK Deck Mount Faucet Mounting Kit, includes (2) 1/2" supply nipples, (2) retainer nuts, (2) lock washers and (2) rubber washers
1 ea Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)
1 ea Model X-0414C Over flow hole, rear centered (modification)

ITEM C23.1 - WELD-IN S/S RINSE SINK (24" X 24" X 14") (2 REQ'D)
SIS No.: *E024

John Boos Model CUT2424146 Dimensions: 14(h) x 24(w) x 24(d)
Weld-In Undermount Sink, 1-compartment, 24"W x 24" front-to-back x 14" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM C23.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8DLX16
Equip Faucet, 8" centers, deck mount, 16" swing nozzle, quarter-turn ceramic cartridge, 2" flange, low-lead, ADA Compliant

ITEM C24 - CEILING-MOUNTED DROP CORD REELS (5-20R) (4 REQ'D) <By E.C.>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM C25 - MICROWAVE OVEN (1 REQ'D)
SIS No.: *E024

ACP Model RMS10TSA Dimensions: 12.25(h) x 20.13(w) x 15.88(d)
Amana® Commercial Microwave Oven, 0.8 cu. ft. capacity, 1000 watts, low volume, 4-stage cooking, (5) power levels, touchpad controls, (20) memory settings, 30-minute max cooking time, interlock safety switch, audible end of cycle signal, LED display, side hinged door with tempered glass, LED lighted interior, stainless steel interior & exterior, 120v/60/1-ph, 13.0 amps, 15 MCA, 1500 watts (total), cord, NEMA 5-15P, cETLus, ETL-Sanitation

1 ea	3-year limited warranty (1 year full)

ITEM C26 - ICE MAKER (1 REQ'D)
SIS No.: *E024

Hoshizaki Model KML-500MAJ Dimensions: 22(h) x 30(w) x 27.38(d)
Ice Maker, Cube-Style, 30"W, air-cooled, self-contained condenser, production capacity up to 442 lb/24 hours at 70°/50° (400 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, 115v/60/1-ph, 7.6 amps, NSF, UL

1 ea	Warranty: 3-Year parts & labor on entire machine
1 ea	Warranty: 5-Year parts & labor on evaporator
1 ea	Warranty: 5-Year parts on compressor & air-cooled condenser
1 ea	Model B-500SF Ice Bin, 30"W, top-hinged front-opening door, 500-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation
1 ea	Warranty: 3-Year parts & labor for bin
1 ea	Model HS-5429 Bin Door Catch (purchase as a service part)
1 pk	Model LP-6 LEG Leg Package, (4) x 6" stainless steel legs
1 ea	Model HS-5607 Scoop Holder Kit
1 ea	Model H9320-51 Water Filtration System, single configuration, 18.4" H (manifold & cartridge)
1 ea	Warranty: 1-Year on entire water filtration system & replaceable elements, standard
1 ea	Model 9795-80 Pre-Filter System, E-10 Prefilter, NSF
1 pk	Model 9534-12 Pre-Filter Replacement Cartridge, EC110 (12 pack)
1 ea	Model H9655-11 Replacement Water Filter Cartridge, each

ITEM C26.1 - ICE BIN (1 REQ'D) <Included>
SIS No.: *E024

Hoshizaki Model B-500SF Dimensions: 46(h) x 30(w) x 32.5(d)
Ice Bin, 30"W, top-hinged front-opening door, 500-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation

1 ea	Warranty: 3-Year parts & labor for bin

ITEM C26.2 - WATER FILTER (1 REQ'D) <Included>
SIS No.: *E024

Hoshizaki Model H9230-51
Refer to Item C26 for Specifications

ITEM C26.3 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM D01 - 3-COMPARTMENT SINK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKS-3-1824-14-24TS Dimensions: 43.75(h) x 102(w) x 29.81(d)
Sink, three compartment, 102"W x 29-13/16"D x 43-3/4"H overall size, 18” wide x 24” front-to-back x 14" deep compartments, (2) left & right 24" drainboards, 9"H backsplash, 8" OC splash mount faucet holes, 1-1/2" rolled edges on front & sides, includes basket drains (BKDR-4), 18/304 stainless steel construction, stainless steel legs & side bracing, adjustable stainless steel over plastic bullet feet, NSF

3 ea Model BK-LWR-3 Twist Lever Drain, fits 3-1/2" opening, 2" male & 1-1/2" female NPT drain outlet, includes overflow cap, brass construction with stainless steel strainer

3 ea Model BK-LDB Lever Drain Bracket, fits twist drains

ITEM D01.1 - SPLASH-MOUNTED PRE-RINSE FAUCET (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-0133-12ACBJST Dimensions: 39.5(h)
Pre-Rinse Unit, with add-on faucet, splash/wall mount, 8" OC, 44" flexible stainless steel hose with B-0107-J-SMV spray valve, 18" riser, add-on faucet with 12" swing spout (includes 2.2 gpm VR aerator), lever handles, Cerama cartridges with check valves, 6" wall bracket, accessory fitting tee & pre-rinse swivel, low lead

ITEM D01.2 - SPLASH-MOUNTED FAUCET W/ SWING SPOU (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8WLX14
Equip Faucet, 8" centers, wall mount, 14" swivel nozzle, 2" flange, ceramic cartridges, low lead, ADA Compliant

ITEM D02 - WALL SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1224 Dimensions: 8(h) x 24(w) x 12(d)
Premium Shelf, wall-mounted, 24"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, NSF

ITEM D03 - WALL SHELF W/ POT RACK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1260-PR Dimensions: 8(h) x 60(w) x 12(d)
Premium Overshelf, wall mount with pot rack, 60"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, (5) stainless steel double prong hooks (BKSSDPH), NSF

ITEM D04 - WALL-MOUNTED S/S HAND SINK (2 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM D04.1 - WALL-MOUNTED SOAP DISPENSER (2 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM D04.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (2 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM D04.2 - EYE WASH FAUCET ATTACHMENT (1 REQ'D)
SIS No.: *E024

BK Resources Model BK-EWS Dimensions: 2.66(h) x 3.13(w)
Eye Wash Attachment, (2) tethered dust cover caps, fits any BK Resources faucet

ITEM D05 - SOILED DISHTABLE (1 REQ'D)
SIS No.: *E024

John Boos Model SDT4-S72SBK-L Dimensions: 44.06(h) x 72(w) x 30.38(d)
Pro-Bowl Soiled Dishtable, straight design, 72"W x 30"D x 44"H overall size, left-to-right operation, (1) 20"W x 20" front-to-back x 8" deep pre-rinse sink bowl, 10"H boxed backsplash with 45° top & 2" return, (1) set of splash mount faucet holes with 8" centers, 2-1/4"H rolled edge, 14/300 stainless steel top, stainless steel legs, bracing, & adjustable bullet feet, NSF

1 ea	SPECIFY DISH MACHINE BRAND AND MODEL. John Boos standard opening is 20-7/8". Certain dish machines require modification at additional cost not shown here.
1 ea	Model X-2201O 30" right end splash, stainless steel (up to 10" in height)
1 ea	Model PB-DTA-20-01 Dish Table Pre-Rinse Basket, with welded slide bar, stainless steel construction, fits 20" x 20" pre-rinse sink

ITEM D05.1 - SPLASH-MOUNTED PRE-RINSE FAUCET (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-0133-CR-BJSTK
EasyInstall Pre-Rinse Unit, 8" wall mount, quarter-turn cerama cartridges with check valves, lever handles, EasyInstall 18" riser, 44" flexible stainless steel hose, 1.07 GPM spray valve with swivel (B-0107-J), 6" wall bracket (B-0109-01), accessory fitting tee, 1/2" NPT female inlets, installation kit (B-0230-K), low lead, NSF, cCSAus

1 ea	3 year limited warranty, standard

ITEM D06 - VENTLESS DOOR-TYPE DISHWASHER (1 REQ'D)
SIS No.: *E024

Champion Model DH-6000T-VHR Dimensions: 79(h) x 33.94(w) x 31.63(d)
Genesis Dishwasher, door type, extended hood (27" opening for trays), ventless heat recovery, high temperature sanitizing with built-in stainless steel electric booster for (40°-70° rise), (40) racks/hour capacity, auto start, single point electrical connection, door interlock switch, on-board service diagnostics, Rinse Sentry feature, auto-fill, detergent & chemical connections, interchangeable upper & lower spray

arms, automatic drain valve, vent fan control, bottom mounted HMI controls, mounted water PRV, stainless steel construction, electric tank heat, peg rack, flat rack, 2 HP self draining pump, NSF, cULus, ENERGY STAR®

1 ea	1 year parts & labor warranty, standard
1 ea	Liftgate (net)
1 ea	Complimentary factory authorized performance test included, upon equipment start-up. Consult local Champion sales representative for coordination of the start-up. If customer is beyond 60 miles from Champion authorized service agent, consult factory.
1 ea	Model 901246 Champion ION Scale Prevention System
1 ea	Single-point electrical connection, standard
1 ea	208-240v/60/1-ph
1 ea	Straight-through design application
1 ea	Model 421926 Drain Water Tempering Kit

ITEM D06.1 - DRAIN WATER TEMPERING KIT (1 REQ'D) <Included>
SIS No.: *E024

Champion Model 421926
Part of Item # D06

ITEM D06.2 - ELECTRICAL DISCONNECT SWITCH (1 REQ'D) <By E.C.>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM D06.3 - WATER SOFTENER (1 REQ'D)
SIS No.: *E024

Everpure Model DEV998053 Dimensions: 27(h) x 23(w) x 11(d)
CES-5600E-15, Single Tank Water Conditioner, 8,768 grains/tank @ 2.25 lbs. salt, 3,897 grains/lb of salt efficiency rating, 0.5 cu.ft. resin volume, 3 gpm continuous @15psi (1 bar), 3/4 inch pipe size, 60 ship weight, 120 operating weight, NSF/ANSI Standard 44 (DEV998053)

ITEM D07 - CLEAN DISHTABLE (1 REQ'D)
SIS No.: *E024

John Boos Model CDT4-S84SBK-R Dimensions: 44.06(h) x 84(w) x 30.38(d)
Pro-Bowl Clean Dishtable, straight design, 84"W x 30"D x 44"H overall size, left-to-right operation, 10"H boxed backsplash with 45° & 2" return, 2-1/4"H rolled edge, 14/300 stainless steel top, stainless steel legs, bracing, & adjustable bullet feet, NSF

1 ea	SPECIFY DISH MACHINE BRAND AND MODEL. John Boos standard opening is 20-7/8". Certain dish machines require modification at additional cost not shown here.

ITEM D08 - WALL SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1272 Dimensions: 8(h) x 72(w) x 12(d)
Premium Shelf, wall-mounted, 72"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (3) 8" angle supports, NSF

ITEM D09 - TUBULAR RACK SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BK-TSH-42 Dimensions: 11.25(h) x 42(w) x 18.63(d)
Tubular Dish Shelf, wall mount, 42"W, slotted mounting holes, 1-5/8" O.D. tubing, 11-1/4"H angle supports, 18/304 stainless steel construction, NSF

ITEM E01 - S/S MOBILE WORK TABLE (1 REQ'D)
SIS No.: *E024

BK Resources Model SVTOB-1836 Dimensions: 36(h) x 36(w) x 18(d)
Work Table, 36"W x 18"D, 18/430 stainless steel top, with turndown edges on all sides, reinforced with channels, open base with stainless steel side & rear bracing, 1-5/8" dia. stainless steel legs, stainless steel over plastic adjustable bullet feet, ships KD, NSF

1 kt Model 5SBR-RA-PLY-PS4 Caster Kit, work table 5" diameter expanding stem, fits 1-5/8" OD tubing, non-marking polyurethane tread, top lock brake, 300 lb. capacity, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180° F, zinc plated, POP box, NSF (4 per kit)

ITEM E02 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Qty: 2
Hood Length (In): 97
Hood Width (In): 66
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 325
Supply Plenum: Yes
Internal End Cutouts: 2

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller sections to accommodate job site conditions there will be additional charges added per section of hood.

ITEM E02.1 - MAKE UP AIR DIFFUSER (3 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to E20 for specifications.

ITEM E02.2 - (LOT) S/S VERTICAL CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to E20 for specifications.

ITEM E02.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to E20 for specifications.

ITEM E02.4 - WALL-MOUNTED MANUAL HOOD FILTER REMOVAL TOOL (1 REQ'D) <Included>
SIS No.: *E024

Halton Model TO BE DETERMINED
Refer to E20 for specifications.

ITEM E02.5 - S/S WALL PANELS (1 REQ'D) <Included>
SIS No.: *E024

Custom Model CUSTOM
Refer to E20 for specifications.

ITEM E03 - GAS CONVECTION OVEN (1 REQ'D)
SIS No.: *E024

Southbend (Middleby) Model TVGS/12SC Dimensions: 26.2(h) x 36.1(w) x 36.5(d)
TruVection Convection Oven, gas, low-profile, single deck, electronic ignition, 150-550°F solid state thermostatic controls, 60 minute mechanical cook timer, oven interior light, cool down fan, includes (3) racks, porcelain oven interior, stainless steel door handle, front, sides, top & 6" legs, 1/2 HP, 52,000 BTU, CSA, NSF

1 ea	Domestic Shipping, inside of North America
1 ea	Standard (1) year limited parts and labor warranty when purchased as a stand alone base or stacked model unit (reference warranty document for details)
1 ea	Natural Gas
1 ea	120v/60/1-ph, 7.9 amps, 6' cord, NEMA 5-15P, standard
1 ea	6" Casters
1 kt	BK Resources Model BKG-GHC-10048-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 1" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 st	Dormont Model PS (PS) Dormont Safety-Set, equipment placement system for all caster-mounted equipment, allows precise, consistent equipment placement under the fire

suppression and ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes two (2) units and hardware pack

1 ea BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM E04 - WALL-MOUNTED S/S HAND SINK (2 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM E04.1 - WALL-MOUNTED SOAP DISPENSER (2 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM E04.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (2 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM E05 - INDUCTION COOKERS (2 REQ'D)
SIS No.: *E024

Equipex LLC Model GL2-7000F Dimensions: 5.5(h) x 14.63(w) x 28.75(d)
Adventys Induction Range, electric, countertop, (2) 8" burners, front-to-back, 3500 watts per burner, capacitive touch controls, (20) power levels, built-in timer, vitroceramic glass surface, automatic pan detection, (2) integral cooling fans per zone and grease filter, stainless steel construction, 208/240v/60/1-ph, 7.0kW, 30.0/34.0 amps, NEMA 6-50P, cETLus, ETL-Sanitation

2 ea Limited 2 year parts & labor warranty

ITEM E06 - REACH-IN FREEZER (1 REQ'D)
SIS No.: *E024

Arctic Air Model AF49 Dimensions: 82.75(h) x 54(w) x 32.75(d)
Freezer, reach-in, two-section, 54"W, 49.0 cu. ft. capacity, electronic thermostat with digital LED display, -10°F to +10°F temperature range, (2) solid hinged self-closing doors with locks (field reversible), remain open door feature, removable magnetic door gasket, (6) adjustable wire shelves, stainless steel front & sides, white aluminum interior with stainless steel floor, (4) 5-1/2"" casters (2 locking), bottom mounted self-contained refrigeration, R290 refrigerant, 1888 BTU/h rejected heated air gain, 7/8 HP, 115v/60/1-ph, 9.0 amps, cord, NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea 2 year parts & labor, 5 years on compressor warranty standard

1 ea Any Arctic Air model installed in mobile application such as concession trailers, food trucks, etc. or in an outdoor venue shall be limited to one (1) year parts, labor, & compressor warranty only. Models ACP40, ACP48, ACP55, ACP63, ACP4SQ, & ACPSQ are limited to one (1) year parts & labor coverage. Models AWR25 and AWF25 are

limited to one (1) year parts & labor coverage and five (5) year compressor warranty. Light bulbs, door gaskets, etc... are limited to a 90-day warranty period & door hinges to a one (1) year period. The warranty is not valid for Residential use.

1 ea Standard warranty only

1 ea 6" casters (2 locking), set of 4, standard

ITEM E07 - REACH-IN REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MBF8005GR Dimensions: 81.3(h) x 51.7(w) x 31.7(d)
Atosa Refrigerator, reach-in, two-section, 51-7/10"W x 31-7/10"D x 81-3/10"H, top mount self-contained refrigeration, 43.2 cu. ft. (2) locking hinged solid doors, digital temperature control, 33° to 40°F temperature range, (6) adjustable shelves, interior LED lighting, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 4" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.2 amps, cord with NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea 2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM E08 - MOBILE PROOFER CABINET (1 REQ'D)
SIS No.: *E024

BK Resources Model HPC1I Dimensions: 67.5(h) x 22.75(w) x 32.5(d)
Proofer/Heater Cabinet, mobile, insulated, full size, holds (35) 18" x 26" pans, 270°-swing removable door, LED thermostat, dual heat/proof control, Proof Mode: up to 115°F temperature & 30 - 95% humidity; Heat Mode: up to 185°F temperature, 120v/60/1-ph, 1.5kW, cord with NEMA 5-15P, NSF, UL

ITEM E09 - ROTATING RACK OVEN (1 REQ'D)
SIS No.: *E024

Doyon Baking Equipment (Middleby) Model SRO1G Dimensions: 100.88(h) x 55(w) x 51(d)
Signature Rack Oven, gas, (1) single rack capacity, side loaded, touchscreen control, front mounted panel, interior lights, standard type II hood, variable air speed with adjustable airflow, reversible door, shot or pulse steam injection, stainless steel construction, 175,000 BTU, cETLus, NSF

1 ea Doyon & NU-VU requires all equipment purchased for shipment outside the countries of US & Canada must complete an Electrical Questionnaire form. This form helps ensure that all equipment is to the correct spec of the site & country. You can download the form at https://doyonnuvubaking.com/Sales/Forms/ElectricalQuestionnaire.pdf. Any questions please contact our factory by phone 800-338-9886 or email sales@nu-vu.com. Thank you.

1 ea Note: Accessories must be ordered with equipment in order to qualify for any additional discounts or special freight pricing. Any questions please contact Doyon/NU-VU.

1 ea INTERNATIONAL ORDERS: Any orders outside the United States or Canada will be subject to a 5% International Warranty Fee added to the invoice

1 ea Two year parts and one year labor warranty, standard

1 ea Assembly Fee, per oven (excludes hospitals, prisons, federal/government installations, marine and other locations with restricted access) (contact factory for details of assembly) (NET)

1 ea NOTE: Assembly for SRO ovens includes: Set equipment in place (uncrate & assemble). Start up consisting of proper equipment function & calibration. Site must be ready to accept oven (which is the responsibility of the kitchen contractor and/or end user).

Please be sure a thorough site inspection has been conducted. This is the responsibility of the kitchen contractor and/or end user.

Does NOT Include: Site inspections, evening, weekend, overtime (or labor on standby), unload, move, transport (or handle the unit in anyway to its final destination in the facility), removal of existing equipment, rack assembly, disposal of packaging, venting, electrical, mechanical & plumbing connections, or customer demonstration.

**This standard assembly service applies for locations within 50 miles of the Doyon & Nu-Vu authorized servicer agent. Special rates apply for locations over 50 miles from a Doyon & Nu-Vu authorized agent. Please Contact Factory for Rates. (Rate does NOT apply to restricted access locations such as Prisons, Hospitals ETC. These will need to be quoted on a case by case basis.

1 ea Natural gas
1 ea See site inspection survey (required with all orders)
1 ea 208-240v/60/1-ph, 12.0 amps, 4.0kW, 3 wires + ground, standard
1 ea Door hinged on left
1 ea Model RSRO1-20 Rack, 20 pan capacity, for SRO1 models
1 ea NOTE: Rack assembly NOT included with oven assembly
1 ea Model 50-1530 Water Filter Assembly for Artisan & SRO (highly recommended by manufacturer)
1 ea Model 50-1531 Replacement Water Filter Cartridge for 50-1530

ITEM E09.1 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM E09.2 - WATER FILTER (1 REQ'D) <Included>
SIS No.: *E024

Doyon Baking Equipment (Middleby) Model 50-1530
Water Filter Assembly for Artisan & SRO (highly recommended by manufacturer)

1 ea Doyon & NU-VU requires all equipment purchased for shipment outside the countries of US & Canada must complete an Electrical Questionnaire form. This form helps ensure that all equipment is to the correct spec of the site & country. You can download the form at https://doyonnuvubaking.com/Sales/Forms/ElectricalQuestionnaire.pdf. Any questions please contact our factory by phone 800-338-9886 or email sales@nu-vu.com. Thank you.
1 ea Note: Accessories must be ordered with equipment in order to qualify for any additional discounts or special freight pricing. Any questions please contact Doyon/NU-VU.

ITEM E10 - S/S WORK TABLE (2 REQ'D)
SIS No.: *E024

BK Resources Model CVT-7230 Dimensions: 34.75(h) x 72(w) x 30(d)
Work Table, 72"W x 30"D x 34-3/4"H, 16/304 stainless steel top reinforced with (2) 2" rectangular steel tubing, adjustable stainless steel undershelf, 1-5/8" dia. stainless steel legs & adjustable bullet feet, NSF

ITEM E11 - S/S WORK TABLE (2 REQ'D)
SIS No.: *E024

BK Resources Model CVT-9630 Dimensions: 34.75(h) x 96(w) x 30(d)
Work Table, 96"W x 30"D x 34-3/4"H, 16/304 stainless steel top reinforced with (2) 2" rectangular steel tubing, adjustable stainless steel undershelf, 1-5/8" dia. stainless steel legs & adjustable bullet feet, NSF

ITEM E12 - 40 QT. MIXER (1 REQ'D)
SIS No.: *E024

Vollrath Model 40759 Dimensions: 47.13(h) x 26.5(w) x 26.56(d)
Planetary Mixer, floor model, 40 quart, 26-1/2"W x 26-/2"D x 47-1/8"H, 3-speed belt driven transmission, #12 attachment hub, digital timer with automatic stop & audible shutoff signal, thermal overload protection, includes: dough hook, wire whisk, flat beater, stainless mixing bowl, safety bowl guard, 1-1/2 HP, 208-240v/60/1-ph, 12 amps, cord with NEMA 6-15P, NSF, cETLus, imported (MIX1040) (Refer to vollrathfoodservice.com for full warranty policy)
1 ea Warranty period is 2 years on parts, 1 year on labor & 5 years on belt

ITEM E13 - S/S WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model CUSTOM
30x180 w/ Backsplash, Side Splash, &
(2) 60" Partial Undershelves

ITEM E13.1 - WELDED-IN S/S SINK (20" X 20" X 12") (2 REQ'D)
SIS No.: *E024

John Boos Model CUT2020126 Dimensions: 12(h) x 20(w) x 20(d)
Weld-In Undermount Sink, 1-compartment, 20"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM E13.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8DLX16
Equip Faucet, 8" centers, deck mount, 16" swing nozzle, quarter-turn ceramic cartridge, 2" flange, low-lead, ADA Compliant

ITEM E14 - WALL SHELF (2 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1272 Dimensions: 8(h) x 72(w) x 12(d)
Premium Shelf, wall-mounted, 72"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (3) 8" angle supports, NSF

ITEM E15 - CEILING-MOUNTED DROP CORD REELS (5-20R) (3 REQ'D) <By E.C.>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM E16 - BUG LIGHT (1 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM E17 - CEILING-MOUNTED DROP CORD REELS (5-20R) (3 REQ'D) <By E.C.>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM E18 - WALL-MOUNTED FIRE SUPPPRESSION SYSTEM (1 REQ'D)
SIS No.: *E024

Halton Model R102
For Items #E02 & F02

Hood Length (In): 193
Ansul System Size: 9 Gallon System
Dwg, Permits & Air Test Only $: D, P & T Not Included
Gas Valves: 2" Electric
Remote Tank Installation: 3
Electrical Automan Reg Release: Yes

Hood Length (In): 228
Ansul System Size: 9 Gallon System
Dwg, Permits & Air Test Only $: D, P & T Not Included
Gas Valves: 2" Electric
Remote Tank Installation: 3
Electrical Automan Reg Release: Yes

Ansul R-102
Pre-Engineered Wet Chemical System per UL300
Single Tank System Enclosed in Stainless Steel Box
Pre-Piped in Factory to include Exhaust Duct
Protection, Plenum Protection, Overhead Appliance
Protection w/ SS Drops, Remote Pull Station and
Microswitches .
SS Piping and SS Elbows are not included by Halton
for any appliance requiring low proxinity
protection under obstructions such as cheese
melters, salamanders, upright broilers etc.
Ansul Hook-up by Certified Technician.
"Electrical contactor/ shunt trip breaker by EC."

ITEM E18.1 - WALL-MOUNTED REMOTE PULL STATION (2 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to E18 for specifications.

ITEM E19 - EXHAUST FAN (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM E19.1 - (LOT) EXHAUST AIR DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM E20 - MAKE UP AIR FAN (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM E20.1 - (LOT) EXHAUST AIR DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

Custom Model CUSTOM
This is not in the Foodservice Equipment Scope

ITEM E21 - FAN CONTROL SYSTEM (DEMAND CONTROL VENTILATION) (1 REQ'D)
SIS No.: *E024

Halton Model M.A.R.V.E.L. BASIC 2
For Items # E02, F02

Hood Qty: 4
ABD Damper Qty: 4
Control Panel w/ Touch Screen: 1
BacNet: IP
Bac Net Qty: 1
Grease Sensor Qty: 2
VFD Qty (10 HP): 1
VFD Cabinet: 1
Start-Up Marvel Hood Qty: 19

ITEM E21.1 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM E21.2 - WALL-MOUNTED ROOM TEMPERATURE SENSOR (1 REQ'D) <Included>
SIS No.: *E024

Halton Model TO BE DETERMINED
Part Of Item #E21 (Fan Control System

ITEM F01 - WALL-MOUNTED S/S HAND SINK (2 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM F01.1 - WALL-MOUNTED SOAP DISPENSER (2 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM F01.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (2 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM F02 - EXHAUST HOOD (1 REQ'D)
SIS No.: *E024

Halton Model KVE
Hood Qty: 2
Hood Length (In): 114
Hood Width (In): 54
Hood Height (In): 24
Style of Hood: Wall Unit
Hood Material: All 300 Stainless
Light Options: LED
Ansul Pre-Pipe: R-102 Pre-Pipe
Switch Panel Qtys: 1
Ceiling Closure Height (In): 18
Ceiling Closure Length (In): 336
Supply Plenum: Yes
Internal End Cutouts: 2

Standard Feature Description Capture-Jet
Listed UL Exhaust Hood; Capture-Jet Fan Technology
T.A.B. (Test Air Balance) Ports; KSA S/S Filters
93-98% Efficient on Particulate in the 5-10
Micron Range Based on ASTM-F2519-05;
KSA Filter Removal Tool
If the hoods have to be broken into smaller
sections to accommodate job site conditions
there will be additional charges added per
section of hood.

ITEM F02.1 - MAKE UP AIR DIFFUSER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model KCD
Hood Supports By Hood Installer

Refer to F02 for specifications.

ITEM F02.2 - (LOT) S/S CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to F02 for specifications.

ITEM F02.3 - MODULATING DAMPER (1 REQ'D) <Included>
SIS No.: *E024

Halton Model CUSTOM
Refer to F02 for specifications.

ITEM F02.4 - S/S WALL PANELS (1 REQ'D) <Included>
SIS No.: *E024

Custom Model CUSTOM
Refer to F02 for specifications.

ITEM F03 - GAS CONVECTION OVEN (2 REQ'D)
SIS No.: *E024

Southbend (Middleby) Model TVGS/12SC Dimensions: 26.2(h) x 36.1(w) x 36.5(d)
TruVection Convection Oven, gas, low-profile, single deck, electronic ignition, 150-550°F solid state thermostatic controls, 60 minute mechanical cook timer, oven interior light, cool down fan, includes (3) racks, porcelain oven interior, stainless steel door handle, front, sides, top & 6" legs, 1/2 HP, 52,000 BTU, CSA, NSF

2 ea	Domestic Shipping, inside of North America
2 ea	Standard (1) year limited parts and labor warranty when purchased as a stand alone base or stacked model unit (reference warranty document for details)
2 ea	Natural Gas
2 ea	120v/60/1-ph, 7.9 amps, 6' cord, NEMA 5-15P, standard
2 ea	4" Low Profile Casters
1 kt	BK Resources Model BKG-GHC-10048-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 1" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 st	Dormont Model PS (PS) Dormont Safety-Set, equipment placement system for all caster-mounted equipment, allows precise, consistent equipment placement under the fire suppression and ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes two (2) units and hardware pack
1 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM F04 - 36"W COUNTERTOP GAS GRIDDLE (1 REQ'D)
SIS No.: *E024

Star (Middleby) Model 636TF Dimensions: 15.5(h) x 36(w) x 29(d)
(MIDDLEBY ESSENTIALS ITEM) Star-Max® Heavy Duty Griddle, gas, countertop, 36" W x 21" D cooking surface, 1" thick polished steel griddle plate, embedded modulating thermostat every 12", heavy duty knob, wrap-around stainless steel splash guard, grease trough & stainless steel drawers, welded steel frame with stainless steel front, 4" legs, 84,900 BTU, cULus, UL EPH Classified, Made in USA, (ships Natural gas includes LP conversion kit)

1 ea	Quick Ship items have limited configurations & that standard configuration may not apply. Contact factory for details
1 ea	2 year parts & labor warranty, standard
1 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM F05 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM F06 - 36"W COUNTERTOP GAS CHARBROILER (2 REQ'D)
SIS No.: *E024

Turbo Air Model TARB-36 Dimensions: 10(h) x 36(w) x 30(d)
Radiance Charbroiler, countertop, gas, 36" wide, 16 ga. stainless steel front plate & wrap, heavy duty cast iron radiant & grates (6) burners with manual controls, removable grease pan, bullnose stainless steel front extension, heat resistant on-off knob, 2" stainless steel standard legs, regulator included, total 90,000 BTU, CSA, CSA-Sanitation

2 ea	Note: Contact factory representative for parts & accessories discounts
2 ea	1 year labor & parts warranty, standard
2 ea	Natural gas
2 ea	Model RCP1002 Regulator, Natural Gas / LP Gas Convertible
2 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
2 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM F07 - GAS FRYER (1 REQ'D)
SIS No.: *E024

Imperial (Middleby) Model IFS-40 Dimensions: 45.75(h) x 15.5(w) x 30.5(d)
(QUICK SHIP) (MIDDLEBY ESSENTIALS ITEM) Fryer, gas, floor model, 40 lb. capacity, tube fired cast iron burners, snap action thermostat, millivolt temperature control, includes: wire mesh crumb screen & (2) nickel-plated baskets, stainless steel front, door, sides, basket hanger & frypot, 6" legs, 105,000 BTU, CSA Flame, CSA Star, NSF, CE (Ships within 1-2 days)

1 ea	Quick Ship items have limited configurations & that standard configuration may not apply. Contact factory for details
1 ea	Limited one year parts and labor warranty, standard

1 ea	Natural gas (must specify elevation if over 2000 ft)
1 ea	Stainless steel tank cover, one per vat, one per vat
1 ea	Joiner strip, stainless steel
1 ea	Swivel casters (set of 4) two with brakes, per set
1 kt	BK Resources Model BKG-GHC-7548-SCK2 Gas Hose Connection Kit # 2, includes 48" long x 3/4" I.D. stainless steel hose with radial wrap & protective translucent coating, (1) quick disconnect, (1) restraining cable & hardware, cCSAus (packaged in point-of-purchase box)
1 ea	BK Resources 5 year warranty on hose, 1 year warranty on quick disconnect & restraining cable, standard

ITEM F07.1 - SIDE SPLASH (1 REQ'D)
SIS No.: *E024

John Boos Model CUSTOM
18" tall side splash mounted to side ofr Item F07

ITEM F08 - FRY DUMP (1 REQ'D)
SIS No.: *E024

Imperial (Middleby) Model IF-DS Dimensions: 44.25(h) x 15.5(w) x 30.5(d)
Fryer Drain Cabinet, 15-1/2", open cabinet base with door, fryer-match design, top drainer section, stainless steel front, sides & drain pan, cETLus, ETL, CE

1 ea	Limited one year parts and labor warranty, standard
1 ea	Heat lamp for drain station
1 ea	120v/60/1-ph for heat lamp
1 ea	Swivel casters, two with break (set of 4)

ITEM F09 - GAS PIZZA OVEN (1 REQ'D)
SIS No.: *E024

Wood Stone Model FD-9660-RFGLR-IR Dimensions: 79.75(h) x 95.75(w) x 67.5(d)
Fire Deck Stone Hearth Oven, radiant gas flame on left and right sides with infrared under floor burner, includes standard stainless mantel, 72" w x 46" d hearth, (40) 8", (24) 10", (15) 12", (8) 16" or (6) 18" pizza capacity, monolithic cast-ceramic floor & dome create "deep heat sink", galvanized steel upper body, heavy duty steel frame base painted black, 12" OD flue collar, ETL-Sanitation, 350,000 BTU

1 ea	Model RECEIVING AND INSTALL RESPONSIBILITIES YOU are responsible for receiving, unloading, and installing the equipment. This includes hiring and scheduling the necessary equipment and staff for offloading upon delivery. Heavy-duty equipment is typically required due to the weight and size of the ovens. Special rigging services and equipment may be needed for installation. For the required equipment for unloading the truck GO TO: https://woodstone-corp.com/unloading-moving/ or call the factory. WE typically have the Truckers call the Site Contact 24-48 hours before delivery so that the site can arrange for any special equipment to be on site when the oven(s) arrive. ALL INSTALLATION Including receiving, warehousing, consolidation, delivery, assembly, set in place, leveling, final connections, decorative facades, and testing is BY OTHERS.
1 ea	Model SHIPPING FOB Bellingham, Washington 98226. Wood Stone transfers ownership of the goods to the buyer once freight has been loaded on the truck in Bellingham.

Regarding Freight Estimates: We strive to get you the best value and pricing on freight from our preferred carriers with experience with our specialized equipment. Estimates are not binding as final dimensions and weights will affect the final shipping cost, as well as any special handling, expediting or delivery address changes. Prices may change due to carrier availability and other factors at the time of shipment. For this reason, do not list freight amounts on your Purchase Order.

1 ea Model TECHNICAL START-UP FOR OVENS Technical Start Up by Wood Stone Authorized Service Agent for OVENS Included. This includes basic inspection of completed mechanical hook-ups to the oven, verification of incoming gas pressure to the oven, verification of burner pressures and proper function of oven components, verification that ventilation is functioning, and a check of basic oven function.

This technical startup does not include initial oven heat-up (which should be performed by customer after the technical start-up), in depth ventilation troubleshooting, certification of duct materials or compliance to ventilation codes, ventilation air balancing, or operational training. This covers labor for work on the oven only; any corrections to external piping, electrical, ventilation is by others. Corrections for improper modifications to the oven are not covered under this start-up. Return trips to verify installation corrections, or due to installation or customer not being ready are not covered. No liability for oven issues or damages, including as a result of improper oven installation or ventilation, is assumed by Wood Stone as a result of this technical start-up. Wood Stone Start-up does not include travel over 50 miles or two hours, overtime, and holiday charges which shall be at the expense of the purchaser.

1 ea Model WARRANTY One year parts and labor. See the Installation Manuals for more details. All Installation Manuals are available on our website: www.woodstone-corp.com, under Resources / Tool Kit.

1 ea Gas type to be specified

1 ea 120v/50/60/1-ph, 2.0 amps, direct wire

1 ea Model WS-GSV-014 Exhaust #014 fan for use with direct connection, includes fan speed control, max. 1400 CFM @ 0.10" W.C., 2.9 amps

1 ea Model 002-800-RES Interlock Relay, to connect fan to oven, GAS ONLY

1 ea Model WS-GSV-014-ADP-12 Fan adapter, 12" round to #014 fan. Needed to attach directly to a round duct system. NOT NEEDED if using an exhaust fan curb (By Others).

1 ea Stainless steel finish

1 ea Model 9660-SSFU Stainless steel UPPER: Front only, upper: stainless steel finish, both sides and back galvanized steel (NOT available with facade ready upper or powder coated upper)

1 ea Model 9660-SSFL Stainless steel LOWER (stand): Front only, lower: stainless steel finish, both sides and back painted steel

1 ea Model 5130-1293 Debris Mantel, removable tray, stainless steel, for FD-9660 & FD-11260 (for factory installation only)

1 ea Model WS-TL-SET-GAS-M Medium Tool Set, for gas ovens, includes (1) utility peel, (1) medium brush set, (1) T-style natural fiber brush, and (1) bubble hook, For Models: 4355, MS4, MS5, TS5, 6045, 8645, 9660, 11260

ITEM F09.1 - EXHAUST FAN (1 REQ'D) <Included>
SIS No.: *E024

Wood Stone Model WS-GSV-014 Dimensions: 13.2(h) x 19.11(w) x 19.11(d)
Exhaust #014 fan for use with direct connection, includes fan speed control, max. 1400 CFM @ 0.10" W.C., 2.9 amps

Supplied by FSEC, Install by HVACC

ITEM F09.2 - DIRECT VENT DUCTWORK (1 REQ'D) <By HVACC>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
Part of Item # F09

ITEM F09.3 - ELECTRICAL DISCONNECT SWITCH (1 REQ'D) <By E.C.>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
Part of Item # F09

ITEM F10 - INDUCTION COOKERS (4 REQ'D)
SIS No.: *E024

Equipex LLC Model GL2-7000F Dimensions: 5.5(h) x 14.63(w) x 28.75(d)
Adventys Induction Range, electric, countertop, (2) 8" burners, front-to-back, 3500 watts per burner, capacitive touch controls, (20) power levels, built-in timer, vitroceramic glass surface, automatic pan detection, (2) integral cooling fans per zone and grease filter, stainless steel construction, 208/240v/60/1-ph, 7.0kW, 30.0/34.0 amps, NEMA 6-50P, cETLus, ETL-Sanitation

4 ea	Limited 2 year parts & labor warranty

ITEM F11 - PIZZA PREP TABLE (1 REQ'D)
SIS No.: *E024

Hoshizaki Model PR67B Dimensions: 43.25(h) x 67(w) x 33.25(d)
Steelheart Series Pizza Prep Table, reach-in, two-section, 19.29 cu. ft., (9) 1/3 pan capacity (pans & adapter bars included), (2) solid hinged doors, (2) adjustable shelves per section, 1/2" thick white polyethylene cutting board, stainless steel exterior front, sides & top, stainless steel interior, self-contained refrigeration system, R290 Hydrocarbon refrigerant, 1/2 HP, NEMA 5-15P, cETLus, ETL-Sanitation

1 ea	Warranty: 7-Year labor on entire machine
1 ea	Warranty: 7-Year parts on entire machine
1 ea	Warranty: 7-Year parts on compressor
1 ea	115v/60/1-ph, 6.0 amps, standard
1 ea	Model HS-5231 Single Overshelf, for 67" cabinet, adjustable top & bottom pass-thru shelving, 16 gauge stainless steel (compatible with models manufactured since January 2017 (Serial number GXXXXXA & after))
1 ea	90 days parts only warranty, standard
1 ea	Casters, 6" (set of 4), (2 with brakes), standard

ITEM F12 - UTILITY CART (2 REQ'D)
SIS No.: *E024

Vollrath Model 97102 Dimensions: 36(h) x 30.5(w) x 18.5(d)
Utility Cart, (3) shelves, 30-1/2"W x 18-1/2"D x 36"H, 10-1/2" between shelves, chrome plated upright & handle, 200 lbs. capacity, plastic, gray finish, (4) 4" swivel casters, KD, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

ITEM F13 - S/S MOBILE WORK TABLE (12 REQ'D)
SIS No.: *E024

BK Resources Model SVT-6030 Dimensions: 36(h) x 60(w) x 30(d)
Work Table, 60"W x 30"D, 18/430 stainless steel top, with turndown edges on all sides, reinforced with channels, adjustable stainless steel undershelf, 1-5/8" dia. stainless steel legs, stainless steel over plastic adjustable bullet feet, NSF

12 kt Model 5SBR-RA-PLY-PS4 Caster Kit, work table 5" diameter expanding stem, fits 1-5/8" OD tubing, non-marking polyurethane tread, top lock brake, 300 lb. capacity, resistant to acids & caustics, double ball bearing, operational temp range -45° to 180° F, zinc plated, POP box, NSF (4 per kit)

ITEM F14 - MOBILE HEATED HOLDING CABINET (8 REQ'D)
SIS No.: *E024

Carter-Hoffmann (Middleby) Model HL3-18 Dimensions: 70.63(h) x 26.5(w) x 31.5(d)
hotLOGIX Holding Cabinet-HL3 Series, one compartment, full height, insulated, (36) 12" x 20" or (18) 18" x 26" pan capacity, 3" fixed wire universal slides, (1) single pane tempered glass door, bottom-mount forced air heating system, mechanical controls, digital thermometer, aluminum construction, (4) 5" swivel casters (2 with brakes), cETLus, ETL-Sanitation (RapidShip)

8 ea 3 Year parts & labor warranty, standard
8 ea 120v/60/1-ph, 1750 watts, 15.0 amps, 8 ft cord with NEMA 5-20P, standard
8 ea Single pane tempered glass door in extruded aluminum, standard

ITEM F15 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM F16 - WALK-IN FREEZER (1 REQ'D)
SIS No.: *E024

AmeriKooler Model CUSTOM
Actual Overall Dimension: 9'-7" x 32'-2" x 9'-4 5/8" (Rectangular)
Description: Compartment 1 of 4 - Indoor Freezer, with Floor
Interior Dim: 8'-11" x 7'-6" x 8'-8 5/8" (w x l x h)
Temperature: -10°F (95°F ambient)
Insulation: 4" thick AK-XPS4 extruded foam with R-values of R-29 for coolers and R-32 for freezers with a 50 Year Thermal Warranty.
UL Classified Core Flame Spread 15, Smoke Rating less than 165.
Warranty: 15 Year Panel Warranty and 1 Year Parts Warranty
Finishes: Interior walls: 26 Ga. Stucco Galvanized White
Exterior walls: 26 Ga. Stucco Embossed Acrylume
Interior ceiling: 26 Ga. Stucco Galvanized White
Exterior ceiling: 26 Ga. Stucco Embossed Acrylume
Floor Type: Type F1-22S
Application: Foot Traffic - No Rolling Carts
NSF Floor panel rated for 700 LBS/ SQ. FT.
22 Ga. Stainless Steel Integral - Not Reinforced
Door: (1) Non-Standard 36" x 78" Left hinged flush door with brushed
hardware. Interior finish: 26 Ga. Stucco Galvanized White, Exterior
finish: 26 Ga. Stucco Embossed Acrylume.36" kickplates to interior and exterior of door. Energy saving temperature regulating
thermostat heater wire and heated relief vent. Heavy duty deadbolt

handle latch with 1/4 turn inside release. 75LC Modularm Multi-Monitor Controller with Temparature Probe and Door Open/Close Sensor for Coolers or Freezers Wired and Installed with MD-1 Motion sensor, IP-1 Panic button/light. 1807 11w, Vapor Proof, 120V. LED fixture. 82 Lumens /watt Angled face . Strip curtain. Requires 115vac. 2.2 amps.
With third hinge, curtain, 12 x 12 heated frame & glass viewing window
Accessories: (2) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33 AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH
Equipment: Refrigeration Supplied By Others
Recommended minimum duty 6940 Btu/hr at 95°F ambient
Accessories: (1) CLOSURE PANEL 26 GA. STUCCO EMBOSSED ACRYLUME 37" X 36" FOR INDOOR BOXES AGAINST BUILDING STRUCTURE
(1) CLOSURE PANEL 26 GA. STUCCO EMBOSSED ACRYLUME 53" X 36" FOR INDOOR BOXES AGAINST BUILDING STRUCTURE
(4) CLOSURE PANEL 26 GA. STUCCO EMBOSSED ACRYLUME 84" X 36" FOR INDOOR BOXES AGAINST BUILDING STRUCTURE
(2) EXTERIOR TRIM 3" X 3" X 108" FOR INDOOR BOXES AGAINST BUILDING STRUCTURE

ITEM F16.1 - STRIP CURTAINS (1 REQ'D)
SIS No.: *E024

HIMI Products Model FC1000
Height (in.) 84
Temperature Range -10 F to 180 F
Anti-discoloration uv treatment
Velco-attached strip system
Double layered strips
Textured clear polyvinyl anti-stick strips
3" strips
Polyvinyl chloride (PVC) material
-10 to 180 degrees fahrenheit temperature range
Dishwasher safe
Convenient mounting system with header (all hardware included)
Decreases cooling equipment run time
Easy to remove strips
97% overlap
Made in USA

ITEM F16.2 - (LOT) S/S LOUVERED CLOSURE PANELS (1 REQ'D) <Included>
SIS No.: *E024

AmeriKooler Model CUSTOM
Refer to F16 for specifications.

ITEM F16.3 - FREEZER EVAPORATOR COIL (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CL6E105DDA

Refrig-448A
H.P. 3
Condensing Unit Model - CFO300L4SEA
Coldzone Evaporator Coils - Model #CL6E090DDA

• ALL EVAPORATOR COILS WILL REQUIRE POWER FROM A HOUSE CIRCUIT UNLESS OTHERWISE STATED
• EVAPORATOR WITH THERMAL EXPANSION VALVE, LIQUID LINE SOLENOID, AND ELECTRONIC ROOM THERMOSTAT
• ALL COMPRESSORS AND CONDENSER CIRCUITS ARE SIZED TO OPERATE AT 95°F AMBIENT
• LIQUID LINE KIT WITH SEALED FILTER/DRIER AND SIGHT GLASS WITH MOISTURE INDICATOR
• EACH SYSTEM SUPPLIED WITH SUCTION LINE KIT INCLUDING A SUCTION LINE FILTER
• EXTERNAL MOUNTED FUSED DISCONNECT
• SYSTEMS WITH HEATED/INSULATED RECEIVERS FOR LOW AMBIENT OPERATION
• FREEZER CONDENSING UNIT(S) WITH SUCTION ACCUMULATOR
• CONDENSING UNITS DO NOT INCLUDE CIRCUIT BREAKERS FOR COMPRESSOR CONTACTOR OR CONTROL CIRCUIT

ITEM F16.4 - DRAIN LINE HEATER (1 REQ'D) <Included>
SIS No.: *E024

Custom Model CUSTOM
Installed By Refrigeration Contractor

ITEM F16.5 - COMPRESSOR (1 REQ'D)
SIS No.: *E024

Coldzone Model CFO300L4SEA
Install & Mount In Curb by HVAC

ITEM F17 - WALK-IN COOLER (1 REQ'D) <Included>
SIS No.: *E024

AmeriKooler Model CUSTOM
Description: Compartment 2 of 4 - Indoor Cooler, with Floor
Interior Dim: 8'-11" x 7'-8" x 8'-8 5/8" (w x l x h)
Temperature: 35°F (95°F ambient)
Insulation: 4" thick AK-XPS4 extruded foam with R-values of R-29 for coolers and R-32 for freezers with a 50 Year Thermal Warranty.
UL Classified Core Flame Spread 15, Smoke Rating less than 165.
Warranty: 15 Year Panel Warranty and 1 Year Parts Warranty
Finishes: Interior walls: 26 Ga. Stucco Galvanized White
Exterior walls: 26 Ga. Stucco Embossed Acrylume
Interior ceiling: 26 Ga. Stucco Galvanized White
Exterior ceiling: 26 Ga. Stucco Embossed Acrylume
Floor Type: Type F1-22S
Application: Foot Traffic - No Rolling Carts
NSF Floor panel rated for 700 LBS/ SQ. FT. 22 Ga. Stainless Steel Integral - Not Reinforced
Door: (1) Standard 36" x 76" Left hinged flush door with brushed hardware.
Interior finish: 26 Ga. Stucco Galvanized White, Exterior finish: 26 Ga. Stucco Embossed Acrylume.36" kickplates to interior and exterior of door. Heavy duty deadbolt handle latch with 1/4 turn

inside release. 75LC Modularm Multi-Monitor Controller with Temparature Probe and Door Open/Close Sensor for Coolers or Freezers Wired and Installed with MD-1 Motion sensor, IP-1 Panic button/light. 1807 11w, Vapor Proof, 120V. LED fixture. 82 Lumens /watt Angled face . Strip curtain. Requires 115vac. 1 amps.
With third hinge, curtain, 12 x 12 heated frame & glass viewing window
Accessories: (2) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33 AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED
ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH
Equipment: Refrigeration Supplied By Others
Recommended minimum duty 6012 Btu/hr at 95°F ambient

ITEM F17.1 - STRIP CURTAINS (1 REQ'D)
SIS No.: *E024

HIMI Products Model FC1000
Height (in.) 84
Temperature Range -10 F to 180 F
Anti-discoloration uv treatment
Velco-attached strip system
Double layered strips
Textured clear polyvinyl anti-stick strips
3" strips
Polyvinyl chloride (PVC) material
-10 to 180 degrees fahrenheit temperature range
Dishwasher safe
Convenient mounting system with header (all hardware included)
Decreases cooling equipment run time
Easy to remove strips
97% overlap
Made in USA

ITEM F17.2 - COOLER EVAPORATOR COIL (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CL6A073ADA
Refrig-448A
H.P. 3/4
Condensing Unit Model - CFO080M4SEA
Coldzone Evaporator Coils - Model # CL6A073ADA

• ALL EVAPORATOR COILS WILL REQUIRE POWER FROM A HOUSE CIRCUIT UNLESS OTHERWISE STATED
• EVAPORATOR WITH THERMAL EXPANSION VALVE, LIQUID LINE SOLENOID, AND ELECTRONIC ROOM THERMOSTAT
• ALL COMPRESSORS AND CONDENSER CIRCUITS ARE SIZED TO OPERATE AT 95°F AMBIENT
• LIQUID LINE KIT WITH SEALED FILTER/DRIER AND SIGHT GLASS WITH MOISTURE INDICATOR
• EACH SYSTEM SUPPLIED WITH SUCTION LINE KIT INCLUDING A SUCTION LINE FILTER
• EXTERNAL MOUNTED FUSED DISCONNECT
• SYSTEMS WITH HEATED/INSULATED RECEIVERS FOR LOW AMBIENT OPERATION
• FREEZER CONDENSING UNIT(S) WITH SUCTION ACCUMULATOR

• CONDENSING UNITS DO NOT INCLUDE CIRCUIT BREAKERS FOR COMPRESSOR CONTACTOR OR CONTROL CIRCUIT

ITEM F17.3 - COMPRESSOR (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CFO080M4SEA
Install & Mount In Curb by HVAC

ITEM F18 - WALK-IN COOLER (1 REQ'D) <Included>
SIS No.: *E024

AmeriKooler Model CUSTOM
Description: Compartment 3 of 4 - Indoor Cooler, with Floor
Interior Dim: 8'-11" x 7'-9" x 8'-8 5/8" (w x l x h)
Temperature: 35°F (95°F ambient)
Insulation: 4" thick AK-XPS4 extruded foam with R-values of R-29 for coolers and R-32 for freezers with a 50 Year Thermal Warranty.
UL Classified Core Flame Spread 15, Smoke Rating less than 165.
Warranty: 15 Year Panel Warranty and 1 Year Parts Warranty
Finishes: Interior walls: 26 Ga. Stucco Galvanized White
Exterior walls: 26 Ga. Stucco Embossed Acrylume
Interior ceiling: 26 Ga. Stucco Galvanized White
Exterior ceiling: 26 Ga. Stucco Embossed Acrylume
Floor Type: Type F1-22S
Application: Foot Traffic - No Rolling Carts
NSF Floor panel rated for 700 LBS/ SQ. FT.
22 Ga. Stainless Steel Integral - Not Reinforced
Door: (1) Standard 36" x 76" Left hinged flush door with brushed hardware.
Interior finish: 26 Ga. Stucco Galvanized White, Exterior finish: 26 Ga. Stucco Embossed Acrylume.36" kickplates to interior and exterior of door. Heavy duty deadbolt handle latch with 1/4 turn inside release. 75LC Modularm Multi-Monitor Controller with
Temparature Probe and Door Open/Close Sensor for Coolers or Freezers Wired and Installed with MD-1 Motion sensor, IP-1 Panic button/light. 1807 11w, Vapor Proof, 120V. LED fixture. 82 Lumens /watt Angled face . Strip curtain. Requires 115vac. 1 amps.
With third hinge, curtain, 12 x 12 heated frame & glass viewing window
Accessories: (2) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33 AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED
ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH
Equipment: Refrigeration Supplied By Others
Recommended minimum duty 5815 Btu/hr at 95°F ambient

ITEM F18.1 - STRIP CURTAINS (1 REQ'D)
SIS No.: *E024

HIMI Products Model FC1000
Height (in.) 84
Temperature Range -10 F to 180 F
Anti-discoloration uv treatment

Velco-attached strip system
Double layered strips
Textured clear polyvinyl anti-stick strips
3" strips
Polyvinyl chloride (PVC) material
-10 to 180 degrees fahrenheit temperature range
Dishwasher safe
Convenient mounting system with header (all hardware included)
Decreases cooling equipment run time
Easy to remove strips
97% overlap
Made in USA

ITEM F18.2 - COOLER EVAPORATOR COIL (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CL6A073ADA
Refrig-448A
H.P. 3/4
Condensing Unit Model - CFO080M4SEA
Coldzone Evaporator Coils - Model # CL6A073ADA

• ALL EVAPORATOR COILS WILL REQUIRE POWER FROM A HOUSE CIRCUIT UNLESS OTHERWISE STATED
• EVAPORATOR WITH THERMAL EXPANSION VALVE, LIQUID LINE SOLENOID, AND ELECTRONIC ROOM THERMOSTAT
• ALL COMPRESSORS AND CONDENSER CIRCUITS ARE SIZED TO OPERATE AT 95°F AMBIENT
• LIQUID LINE KIT WITH SEALED FILTER/DRIER AND SIGHT GLASS WITH MOISTURE INDICATOR
• EACH SYSTEM SUPPLIED WITH SUCTION LINE KIT INCLUDING A SUCTION LINE FILTER
• EXTERNAL MOUNTED FUSED DISCONNECT
• SYSTEMS WITH HEATED/INSULATED RECEIVERS FOR LOW AMBIENT OPERATION
• FREEZER CONDENSING UNIT(S) WITH SUCTION ACCUMULATOR
• CONDENSING UNITS DO NOT INCLUDE CIRCUIT BREAKERS FOR COMPRESSOR CONTACTOR OR CONTROL CIRCUIT

ITEM F18.3 - COMPRESSOR (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CFO080M4SEA
Install & Mount In Curb by HVAC

ITEM F19 - WALK-IN COOLER (1 REQ'D) <Included>
SIS No.: *E024

AmeriKooler Model CUSTOM
Description: Compartment 4 of 4 - Indoor Cooler, with Floor
Interior Dim: 8'-11" x 7'-7" x 8'-8 5/8" (w x l x h)
Temperature: 35°F (95°F ambient)
Insulation: 4" thick AK-XPS4 extruded foam with R-values of R-29 for coolers and R-32 for freezers with a 50 Year Thermal Warranty.
UL Classified Core Flame Spread 15, Smoke Rating less than 165.
Warranty: 15 Year Panel Warranty and 1 Year Parts Warranty

Finishes: Interior walls: 26 Ga. Stucco Galvanized White
Exterior walls: 26 Ga. Stucco Embossed Acrylume
Interior ceiling: 26 Ga. Stucco Galvanized White
Exterior ceiling: 26 Ga. Stucco Embossed Acrylume
Floor Type: Type F1-22S
Application: Foot Traffic - No Rolling Carts
NSF Floor panel rated for 700 LBS/ SQ. FT.
22 Ga. Stainless Steel Integral - Not Reinforced
Door: (1) Standard 36" x 76" Left hinged flush door with brushed hardware.
Interior finish: 26 Ga. Stucco Galvanized White, Exterior finish: 26 Ga. Stucco Embossed Acrylume.36" kickplates to interior and exterior of door. Heavy duty deadbolt handle latch with 1/4 turn inside release. 75LC Modularm Multi-Monitor Controller with Temparature Probe and Door Open/Close Sensor for Coolers or Freezers Wired and Installed with MD-1 Motion sensor, IP-1 Panic button/light. 1807 11w, Vapor Proof, 120V. LED fixture. 82 Lumens /watt Angled face . Strip curtain. Requires 115vac. 1 amps.
With third hinge, curtain, 12 x 12 heated frame & glass viewing window
Accessories: (2) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33 AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH
Equipment: Refrigeration Supplied By Others
Recommended minimum duty 6090 Btu/hr at 95°F ambient
Freight Freight included to NY 10994
Truckload TMS : Q070220241K

ITEM F19.1 - STRIP CURTAINS (1 REQ'D)
SIS No.: *E024

HIMI Products Model FC1000
Height (in.) 84
Temperature Range -10 F to 180 F
Anti-discoloration uv treatment
Velco-attached strip system
Double layered strips
Textured clear polyvinyl anti-stick strips
3" strips
Polyvinyl chloride (PVC) material
-10 to 180 degrees fahrenheit temperature range
Dishwasher safe
Convenient mounting system with header (all hardware included)
Decreases cooling equipment run time
Easy to remove strips
97% overlap
Made in USA

ITEM F19.2 - COOLER EVAPORATOR COIL (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CL6A073ADA
Refrig-448A
H.P. 3/4
Condensing Unit Model - CFO080M4SEA

Coldzone Evaporator Coils - Model # CL6A073ADA

• ALL EVAPORATOR COILS WILL REQUIRE POWER FROM A HOUSE CIRCUIT UNLESS OTHERWISE STATED
• EVAPORATOR WITH THERMAL EXPANSION VALVE, LIQUID LINE SOLENOID, AND ELECTRONIC ROOM THERMOSTAT
• ALL COMPRESSORS AND CONDENSER CIRCUITS ARE SIZED TO OPERATE AT 95°F AMBIENT
• LIQUID LINE KIT WITH SEALED FILTER/DRIER AND SIGHT GLASS WITH MOISTURE INDICATOR
• EACH SYSTEM SUPPLIED WITH SUCTION LINE KIT INCLUDING A SUCTION LINE FILTER
• EXTERNAL MOUNTED FUSED DISCONNECT
• SYSTEMS WITH HEATED/INSULATED RECEIVERS FOR LOW AMBIENT OPERATION
• FREEZER CONDENSING UNIT(S) WITH SUCTION ACCUMULATOR
• CONDENSING UNITS DO NOT INCLUDE CIRCUIT BREAKERS FOR COMPRESSOR CONTACTOR OR CONTROL CIRCUIT

ITEM F19.3 - COMPRESSOR (1 REQ'D) <Included>
SIS No.: *E024

Coldzone Model CFO080M4SEA
Install & Mount In Curb by HVAC

ITEM F20 - CEILING-MOUNTED DROP CORD REELS (5-20R) (8 REQ'D) <By E.C.>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM G01 - WALL-MOUNTED S/S HAND SINK (3 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM G01.1 - WALL-MOUNTED SOAP DISPENSER (3 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM G01.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (3 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM G01.3 - EYE WASH FAUCET ATTACHMENT (1 REQ'D)
SIS No.: *E024

BK Resources Model BK-EWS Dimensions: 2.66(h) x 3.13(w)
Eye Wash Attachment, (2) tethered dust cover caps, fits any BK Resources faucet

ITEM G02 - 3-COMPARTMENT SINK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKS-3-1824-14-24TS Dimensions: 43.75(h) x 102(w) x 29.81(d)
Sink, three compartment, 102"W x 29-13/16"D x 43-3/4"H overall size, 18” wide x 24” front-to-back x 14" deep compartments, (2) left & right 24" drainboards, 9"H backsplash, 8" OC splash mount faucet holes, 1-1/2" rolled edges on front & sides, includes basket drains (BKDR-4), 18/304 stainless steel construction, stainless steel legs & side bracing, adjustable stainless steel over plastic bullet feet, NSF

3 ea	Model BK-LWR-1O Twist Lever Drain, with overflow, fits 3-1/2" opening, 2" male & 1-1/2" female NPT drain outlet, brass construction with stainless steel strainer
3 ea	Model BK-LDB Lever Drain Bracket, fits twist drains

ITEM G02.1 - SPLASH-MOUNTED PRE-RINSE FAUCET (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-0133-12ACBJST Dimensions: 39.5(h)
Pre-Rinse Unit, with add-on faucet, splash/wall mount, 8" OC, 44" flexible stainless steel hose with B-0107-J-SMV spray valve, 18" riser, add-on faucet with 12" swing spout (includes 2.2 gpm VR aerator), lever handles, Cerama cartridges with check valves, 6" wall bracket, accessory fitting tee & pre-rinse swivel, low lead

ITEM G02.2 - SPLASH-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model 5F-8WLX14
Equip Faucet, 8" centers, wall mount, 14" swivel nozzle, 2" flange, ceramic cartridges, low lead, ADA Compliant

ITEM G03 - WALL SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1224 Dimensions: 8(h) x 24(w) x 12(d)
Premium Shelf, wall-mounted, 24"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, NSF

ITEM G04 - WALL SHELF W/ POT RACK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1260-PR Dimensions: 8(h) x 60(w) x 12(d)
Premium Overshelf, wall mount with pot rack, 60"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, (5) stainless steel double prong hooks (BKSSDPH), NSF

ITEM G05 - WORK TABLE (1 REQ'D)
SIS No.: *E024

John Boos Model ST6R5-30144SSK Dimensions: 40.75(h) x 144(w) x 30(d)
Work Table, 144"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea	Model CUT1620126 Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
1 ea	Model X-0205B On the right (modification)
1 ea	Model PB-LWR-1OV Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, overflow outlet & basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)
1 ea	Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-1OV straight handle lever waste.
1 ea	Note: Provisions made at factory for installation.
1 ea	Model X-0414C Over flow hole, rear centered (modification)

ITEM G05.1 - WELD-IN S/S RINSE SINK (16" X 20" X 12") (1 REQ'D) <Included>
SIS No.: *E024

John Boos Model CUT1620126 Dimensions: 12(h) x 16(w) x 20(d)
Weld-In Undermount Sink, 1-compartment, 16"W x 20" front-to-back x 12" deep, 3-1/2" drain opening, 16/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)

ITEM G05.2 - DECK-MOUNTED FAUCET W/ SWING SPOUT (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-1123-CR
Faucet Workboard, swivel, deck mount, 12" long, standard, 8" centers, lever handles, cerama cartridges, check valves, includes: lock washer (014200-45), 2.2 GPM aerator, low-lead, polished chrome, 1/2" male NPT, ADA Compliant, ANSI, NSF

ITEM G06 - WALL SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1284 Dimensions: 8(h) x 84(w) x 12(d)
Premium Shelf, wall-mounted, 84"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (3) 8" angle supports, NSF

ITEM G07 - COUNTERTOP BULK COFFEE BREWER (1 REQ'D)
SIS No.: *E024

FETCO Model CBS-52H-15 (C52046) Dimensions: 36(h) x 21(w) x 16(d)
Handle Operated Series Coffee Brewer, twin, 1.5 gallon capacity, automatic, on/off switch, two-portion standard, gravity flow dispense tube system, programmable recipes, gourmet coffee brew basket locks during brew cycle, hot water service, tank drain, 3 x 4.0kW heaters, 120/208-240v, 3-ph, 4+G wires, 25.6 - 29.6 max amp draw, 9.1 - 12.1kW, terminal block, 22.5 - 30.0 gallons per hour, UL, cUL, NSF (Use with FETCO D449, D452, or D009 - sold separately)

1 ea	NOTE: Pricing and specifications subject to change with or without notice - Please call 1.800.FETCO.99 for confirmation
1 ea	Circuit board: 3 year parts & 1 year labor warranty, standard

1 ea Electro-mechanical parts: 2 year parts & 1 year labor warranty, standard
1 ea All other parts: 1 year parts & 1 year labor warranty, standard

ITEM G07.1 - COUNTERTOP INSULATED COFFEE SERVERS (2 REQ'D)
SIS No.: *E024

FETCO Model D449TLA Dimensions: 23(h) x 9(w) x 13.25(d)
L4D-15TLA LUXUS® Thermal Dispenser, 1.5 gallon, Freshness Timer®, Volume Indicator™, vacuum insulated, flip & hide fill-through lid, base with built-in handles and drip tray, touchless antimicrobial Omni Pro faucet handle
2 ea NOTE: Pricing and specifications subject to change with or without notice - Please call 1.800.FETCO.99 for confirmation
2 ea 1 year parts warranty, standard

ITEM G08 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM G09 - WATER FILTER (1 REQ'D)
SIS No.: *E024

Everpure Model QC7I PF TWIN 7FC-S Dimensions: 25.25(h) x 21.75(w) x 6(d)
QC7I Water Filtration System, QC7I PF Twin 7FC-S, (1) EC210 prefilter, (2) 7FC-S Fibredyne® carbon block cartridges, reduces sediment, chlorine, taste & odor, cyst, turbidity, inhibits scale, 50,000 gallons capacity, 5.0 gpm flow rate, 0.2 micron, inlet water shut-off valve, outlet pressure gauge, flush valve, 3/4" inlet/outlet connections, NSF 42 & 53, (EV932892)
1 ea Model EV953426 Replacement Cartridge: EC210 Prefilter Cartridge, EC210, (6) EC210 cartridges, sediment reduction, 10 micron (EV953426)
2 ea Model EV969271 Replacement Cartridge: 7FC-S Water Filter Cartridge, 7FC-S, (1) 7FC-S Fibredyne® II submicron carbon block cartridge, reduces cysts, chlorine, taste & odors, inhibits bacterial growth & scale, 25,000 gallons, 2.5 gpm, 0.2 micron, NSF 42 & 53 (EV969271)

ITEM G10 - UTILITY CART (6 REQ'D)
SIS No.: *E024

Vollrath Model 97102 Dimensions: 36(h) x 30.5(w) x 18.5(d)
Utility Cart, (3) shelves, 30-1/2"W x 18-1/2"D x 36"H, 10-1/2" between shelves, chrome plated upright & handle, 200 lbs. capacity, plastic, gray finish, (4) 4" swivel casters, KD, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

ITEM G11 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM G12 - CUSTOM U-SHAPED SOILED DISHTABLE (1 REQ'D)
SIS No.: *E024

John Boos Model SDT6-K6084SBK-R Dimensions: 44.06(h)
Pro-Bowl Soiled Dishtable, corner design, 60" machine to corner, 84" corner to end, 44"H overall size, L-shaped, right-to-left operation, (1) 20"W x 20" front-to-back x 8" deep pre-rinse sink bowl, 10"H boxed

backsplash with 45° top & 2" return, (1) set of splash mount faucet holes with 8" centers, 2-1/4"H rolled edge, 16/300 stainless steel top, stainless steel legs, bracing, & adjustable bullet feet, NSF

1 ea SPECIFY DISH MACHINE BRAND AND MODEL. John Boos standard opening is 20-7/8". Certain dish machines require modification at additional cost not shown here.
1 ea Model X-0002L Size modification to 36" W x 84" W
3 ea Model X-0411B Remove length of drainboard from dish machine opening end only (per 6” intervals, max 3 deducts per table) (modification) (DEDUCT)
1 ea Model SCRAP-BLOCK-5.75 Scrap Block, rubber, installed
1 ea Model X-CUT02 Scrap Hole Cutout, in stainless, 6" diameter
1 ea Model DTSS-3084-T Sorting Shelf, tubular design, double sided, 84"W x 30-1/2"D x 32"H, 1-5/8" diameter uprights, for use with soiled dish table, both ends table mount or one end wall mounted and one end table mounted, stainless steel construction

ITEM G12.1 - WELDED-IN S/S SINK (20" X 20" X 8") (1 REQ'D)
SIS No.: *E024

John Boos Model CUSTOM Dimensions: 20(h) x 20(w) x 8(d)
Weld-In Sink, one compartment, 20"W x 20"D x 8" deep, 3/4" covered corners, bottom crowned to 3-1/2" embossed opening, slope drain, interior seams polished, exterior seams unpolished, 16/304 stainless steel construction, NSF C2

ITEM G12.2 - SPLASH-MOUNTED PRE-RINSE FAUCET (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-0133-CR-BJSTK
EasyInstall Pre-Rinse Unit, 8" wall mount, quarter-turn cerama cartridges with check valves, lever handles, EasyInstall 18" riser, 44" flexible stainless steel hose, 1.07 GPM spray valve with swivel (B-0107-J), 6" wall bracket (B-0109-01), accessory fitting tee, 1/2" NPT female inlets, installation kit (B-0230-K), low lead, NSF, cCSAus

1 ea 3 year limited warranty, standard

ITEM G12.3 - TABLE-MOUNTED DOUBLE-SIDED RACK SHELF (1 REQ'D) <Included>
SIS No.: *E024

John Boos Model CUSTOM
Refer to G12 for specifications.

ITEM G13 - VENTLESS CONVEYOR DISHWASHER (1 REQ'D)
SIS No.: *E024

Champion Confidential Model 44 PRO-VHR Dimensions: 89(h) x 60(w) x 33.13(d)
Pro Series, 44”W rack conveyor dishwasher, ventless heat recovery technology, proportional rinse, progressive anti-jam drive system, top mounted control panel with HMI user interface, Proactive maintenance software, 100 gallons per hour with energy sentinel (idle pump shut-off), (209) racks per hour, built-in 70° rise booster, electric tank heat, single-piece hood design, single-piece stainless steel upper & lower wash arms manifolds, single removable scrap screen per tank, 20” standard vertical clearance which accommodate 18” x 26” sheet pans, full 180° opening leak proof insulated hinged access doors, automatic tank fill, door safety switches, leak-proof ball valve drains, lower front & side enclosure panels, stainless steel heavy gauge construction including base & legs, electric tank heat, 2 HP wash pump, single point machine & separate booster connection, vent fan control, stainless steel rear

manifolds, includes: (2) 20" x 20" peg racks & (1) 20" x 20" flat rack, NSF Pot & Pan mode, CULus, Made in USA

1 ea Model REASSEMBLY HEAT PUMP REQUIRED Reassembly for Heat Pump:

Dealer is responsible for providing installation site information upon order and giving 3 week's advanced notice for ASA to meet onsite for reassembly. Dishwasher must be delivered and onsite in the dishroom, near its final installation point prior to ASA arrival. ASA will place the heat pump on the dishwasher and make all internal plumbing and electrical connections. ASA is not responsible for final connections of power and water to the dishwasher, setting it in place, connecting tables, or any other part of the installation. If the dishwasher is already against the wall when ASA arrives, dealer is responsible to remove the dishwasher from the wall and additional trip charges may apply. It is critical you coordinate with Champion Service (1-800-858-4477) before beginning installation of this dish machine.

Price of reassembly is good within 60 miles from an Authorized Service Provider. Longer distances will increase the rate. Heat pump will also be invoiced upon shipment of the dishwasher.

PRICE IS NET/NET WITH NO FURTHER DISCOUNTS AND REBATES

1 ea 1 year parts & labor warranty, standard
1 ea Dual point electrical connection (1) machine (2) built-in booster (completed in the field by certified electrician) (standard)
1 ea Direction of operation to be specified
1 ea Voltage to be determined
1 ea Electric tank heat, standard
1 ea Electric booster, 70° rise, built-in
1 ea Drain water tempering kit (un-mounted)
1 ea Model 407400 Table Limit Switch (Whisker Style) Table limit switch, includes: 12 ft. pre-wired cord standard (unmounted) (recommended on all conveyor models)

ITEM G13.1 - ADDITIONAL UTILITY INFORMATION FOR BOOSTER (1 REQ'D) <Included>
SIS No.: *E024

Champion Model CUSTOM
Part of Item # G13

ITEM G13.2 - TABLE LIMIT SWITCH (1 REQ'D) <Included>
SIS No.: *E024

Champion Model CUSTOM
Refer to G13

ITEM G13.3 - DRAIN WATER TEMPERING KIT (1 REQ'D) <Included>
SIS No.: *E024

Champion Model CUSTOM
Drain Water Tempering Kit, 120v/60/1-ph (separate 120v connection required) (Rack Conveyor Models)

ITEM G13.4 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM G13.5 - WATER SOFTENER (1 REQ'D)
SIS No.: *E024

Everpure Model DEV998053 Dimensions: 27(h) x 23(w) x 11(d)
CES-5600E-15, Single Tank Water Conditioner, 8,768 grains/tank @ 2.25 lbs. salt, 3,897 grains/lb of salt efficiency rating, 0.5 cu.ft. resin volume, 3 gpm continuous @15psi (1 bar), 3/4 inch pipe size, 60 ship weight, 120 operating weight, NSF/ANSI Standard 44 (DEV998053)

ITEM G14 - CLEAN DISHTABLE (1 REQ'D)
SIS No.: *E024

John Boos Model CDT4-S108SBK-L Dimensions: 44.06(h) x 108(w) x 30.38(d)
Pro-Bowl Clean Dishtable, straight design, 108"W x 30"D x 44"H overall size, right-to-left operation, 10"H boxed backsplash with 45° & 2" return, 2-1/4"H rolled edge, 14/300 stainless steel top, stainless steel legs, bracing, & adjustable bullet feet, NSF
1 ea SPECIFY DISH MACHINE BRAND AND MODEL. John Boos standard opening is 20-7/8". Certain dish machines require modification at additional cost not shown here.
1 ea Model X-0413G Limit Switch Provision (limit switch by KEC) (modification)

ITEM G15 - WALL SHELF (1 REQ'D)
SIS No.: *E024

BK Resources Model BKWS-1260 Dimensions: 8(h) x 60(w) x 12(d)
Premium Shelf, wall-mounted, 60"W x 12"D, 18/304 stainless steel, 1-1/2"H rear up-turn, (2) 8" angle supports, NSF

ITEM H01 - RACK DOLLY (7 REQ'D)
SIS No.: *E024

Crestware Model RDOLLY2
Rack Dolly, extra thick base, with casters, 120 lb. capacity (handle sold separately)

ITEM H02 - DISH DOLLY (5 REQ'D)
SIS No.: *E024

Metro Model PCD12 Dimensions: 31.94(h) x 30.13(w) x 30.13(d)
Poker Chip Dish Dolly, 30-1/8"W x 30-1/8"D x 31-15/16"H, non-adjustable, (240) maximum dish: size 12-5/8" (4) columns (approximately 60 dishes per column), 2-handed access, recessed handles, 5"Dia. swivel casters (2 with brakes) with neoprene wheels, chip-resistant polymer shell with Microban® antimicrobial protection, aesthetic blue, vinyl dust/water splash cover, NSF
5 ea Model PROP 65 WARNING: This product can expose you to chemicals, including DEHP, which are known to the State of California to cause cancer, birth defects and other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

ITEM J01 - MILK COOLER (1 REQ'D)
SIS No.: *E024

Traulsen Model RMC49D4 Dimensions: 46(h) x 49(w) x 34.25(d)
Spec-Line Forced-Air Double Access Milk Cooler, sliding door, holds (12) 13"x13" crates or (8) 13"x19" milk crates, stainless steel interior and exterior, reinforced floor, sliding caster rails , (3) heavy-duty

stainless steel dunnage racks, top-mount refrigeration system, digital control, E-Z clean gaskets, floor drain, 4" factory mounted adjustable casters,R-290 refrigerant, 1/4 hp, cETLus, ETL

1 ea 6-year parts & labor and 7 year compressor, standard. Visit www.traulsen.com for details

1 ea 115v/60/1-ph, 7.2 amps, NEMA 5-15P

ITEM J02 - REFRIGERATED COLD FOOD STATION (2 REQ'D)
SIS No.: *E024

Vollrath Model 37045 Dimensions: 34(h) x 46(w) x 28(d)
4-Series Signature Server® Stainless Steel Countertop with Cold Food Station, self contained refrigeration, 46"W x 28"D x 34"H, modular, enclosed base, with stainless steel 19-7/8" x 37-1/2" x 8" deep top well, 3-pan size, self-contained refrigeration, 1/4 hp, 120v, 3.5 amps, NEMA 5-15P, Made in USA, NSF, cULus (Refer to vollrathfoodservice.com for full warranty policy)

2 ea 1 year warranty against defects in materials & workmanship

2 ea 120v/60/1-ph

2 ea Model 36693 All Stainless finish for 4-Series Signature Server® with stainless steel countertops Corner Station & 46"W models (Refer to vollrathfoodservice.com for full warranty policy)

2 ea Model SS-6BG-031C-LED 6-Series Velocity Cafeteria-Style Breath Guard, adjustable, for 3-pan/well 4-series front-of-house serving system, 45"W x 3/8" thick tempered glass panels, 11 gauge stainless steel tubing, (8) pre-set positions, accommodate full-serve, self-serve, & horizontal positions, push-button mechanism enables single-person adjustment, LED light strip: 120-volt, 840 watt, 7.0 amp, 60 hz, NSF, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

2 ea Model 9879303 Upgrade to 14 gauge stainless steel work surface for, 46"W 4-Series Signature Server® Cold Pan (required for this breath guard)

2 ea Model 3752250-2-C 4-Series Signature Server® V-rib Tray Slide, for customer side, 46"W x 12"D, fold-down/lift-off brackets (Refer to vollrathfoodservice.com for full warranty policy)

2 ea Model 3751250-2-O Operator Side- Plate Rest, with lift-off bracket, ADA 4-Series Signature Server® with Stainless Steel Countertops, 46" 7" Overall Width (Refer to vollrathfoodservice.com for full warranty policy)

2 ea Model 36914-2 Perforated False Bottom for 4-Series Signature Server® with Stainless Steel Countertops 46" Cold Food Pan Station (Refer to vollrathfoodservice.com for full warranty policy)

2 st Model SS4CASTERS 4-Series Signature Server® Swivel Casters, 4"H, (2) braked, standard

ITEM J03 - 3-WELL HOT FOOD STATION (2 REQ'D)
SIS No.: *E024

Vollrath Model 37030 Dimensions: 34(h) x 46(w) x 28(d)
4-Series Signature Server® Hot Food Serving Counter, 46"W x 28"D x 34"H, 18/300 stainless steel top with 1" turndown on all sides, (3) 12" x 20" x 6-3/8" deep wells with 625 watt elements, individual Touch-Temp® programmable controls, enclosed base, 18/400 series stainless steel unibody construction, pull-out ball valve drain, 1875 watts, cord, plug, cULus, NSF, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

2 ea 1 year warranty against defects in materials & workmanship

2 st Model SS4CASTERS 4-Series Signature Server® Swivel Casters, 4"H, (2) braked, standard

2 ea 120/208v/60/1-ph

2 ea Model 36693 All Stainless finish for 4-Series Signature Server® with stainless steel countertops Corner Station & 46"W models (Refer to vollrathfoodservice.com for full warranty policy)
2 ea Model SS-6BG-031C-HSL 6-Series Velocity Cafeteria-Style Breath Guard, adjustable, for 3-pan/well 4-series front-of-house serving system, 45"W x 3/8" thick tempered glass panels, 11 gauge stainless steel tubing, (8) pre-set positions, accommodate full-serve, self-serve, & horizontal positions, push-button mechanism enables single-person adjustment, heat strip with LED lighting: 120-volt, 840 watt, 7.0 amp, & 60 hz, NSF, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)
2 ea Model 9879203 Upgrade to 14 gauge stainless steel work surface for, (3) well 46"W 4-Series Signature Server® Hot Food Base (required for this breath guard)
2 ea Model 3751250-2-O Operator Side- Plate Rest, with lift-off bracket, ADA 4-Series Signature Server® with Stainless Steel Countertops, 46" 7" Overall Width (Refer to vollrathfoodservice.com for full warranty policy)
2 ea Model 3752250-2-C 4-Series Signature Server® V-rib Tray Slide, for customer side, 46"W x 12"D, fold-down/lift-off brackets (Refer to vollrathfoodservice.com for full warranty policy)

ITEM J04 - WALL-MOUNTED S/S HAND SINK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKHS-D-SS-SS-P-G Dimensions: 12(w) x 16(d)
Space Saver Hand Sink, wall mount, 9" wide x 9" front-to-back x 5" deep bowl, 4" OC deck mount faucet (BKD-3G-G, lead free), marine edge, side splashes on left & right, 7-1/2"H backsplash, includes basket drain & wall mounting hardware, 304 stainless steel construction, NSF

ITEM J04.1 - WALL-MOUNTED SOAP DISPENSER (1 REQ'D) <By Vendor>
SIS No.: *E024

To Be Determined Model TO BE DETERMINED
This is not in the Foodservice Equipment Scope

ITEM J04.2 - WALL-MOUNTED PAPER TOWEL DISPENSER (1 REQ'D) <By G/C>
SIS No.: *E024

Georgia Pacific Model 59488A
This is not in the Foodservice Equipment Scope

ITEM J05 - REFRIGERATED PREP TABLE (1 REQ'D)
SIS No.: *E024

Hoshizaki Model SR48B-12 Dimensions: 44.25(h) x 48(w) x 35(d)
Steelheart Series Sandwich Top Refrigerator, reach-in, two-section, 48"W, 13.66 cu. ft., self-contained rear mounted refrigeration system, (2) solid hinged doors, (2) adjustable shelves, provided with (12) 1/6 pans 4" deep, 6" maximum pan depth (top rail), 10" D x 1/2" thick white polyethylene cutting board & a full set of adapter bars, stainless steel interior, stainless steel exterior front, sides & hinged top cover, (4) 6" casters (2 with brakes), hot gas condensate removal, R290 hydrocarbon refrigerant, 1/5 HP, cord, NEMA 5-15P, cETLus, ETL-Sanitation
1 ea Warranty: 7-Year labor on entire machine
1 ea Warranty: 7-Year parts on entire machine
1 ea Warranty: 7-Year parts on compressor

1 ea 115v/60/1-ph, 3 amps, standard
1 ea Model HS-5074 Stainless Steel Lift-Off Cover, flat, for 12-pan Sandwich top opening

ITEM J06 - REACH-IN REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MBF8005GR Dimensions: 81.3(h) x 51.7(w) x 31.7(d)
Atosa Refrigerator, reach-in, two-section, 51-7/10"W x 31-7/10"D x 81-3/10"H, top mount self-contained refrigeration, 43.2 cu. ft. (2) locking hinged solid doors, digital temperature control, 33° to 40°F temperature range, (6) adjustable shelves, interior LED lighting, automatic evaporation, air defrost, stainless steel interior & exterior, galvanized steel back, 4" casters, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.2 amps, cord with NEMA 5-15P, cETLus, ETL-Sanitation, ENERGY STAR®
1 ea 2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM J07 - MOBILE HEATED HOLDING CABINET (4 REQ'D)
SIS No.: *E024

Carter-Hoffmann (Middleby) Model HL3-18 Dimensions: 70.63(h) x 26.5(w) x 31.5(d)
hotLOGIX Holding Cabinet-HL3 Series, one compartment, full height, insulated, (36) 12" x 20" or (18) 18" x 26" pan capacity, 3" fixed wire universal slides, (1) single pane tempered glass door, bottom-mount forced air heating system, mechanical controls, digital thermometer, aluminum construction, (4) 5" swivel casters (2 with brakes), cETLus, ETL-Sanitation (RapidShip)
4 ea 3 Year parts & labor warranty, standard
4 ea 120v/60/1-ph, 1750 watts, 15.0 amps, 8 ft cord with NEMA 5-20P, standard
4 ea Single pane tempered glass door in extruded aluminum, standard

ITEM J08 - SPARE NO. <Spare No.>
SIS No.: *E024

ITEM J09 - POWER POLE (1 REQ'D)
SIS No.: *E024

Avtec Model ELECTRA POLEM
1 EA ELECTRA-POLE-EPOL ELECTRA POLE
1 EA LI15A03DC0-EPOLE LINK PLATE, 15A, 120/1, GFCI, NEMA 5-15R ST. BL., DUPLEX
3 EA LI20A03DC0-EPOL LINK PLATE, 20A, 120/1, GFCI, NEMA 5-20R DUPLEX
1 EA ASSEMBLY PARTS-EPOL STANDARD ELECTRA POLE ACCESSORIES

ITEM J09.1 - POWER POLE (1 REQ'D)
SIS No.: *E024

Avtec Model ELECTRA POLEM
1 EA ELECTRA-POLE-EPOL ELECTRA POLE
2 EA LI15A03DC0-EPOLE LINK PLATE, 15A, 120/1, GFCI, NEMA 5-15R ST. BL., DUPLEX
2 EA LI20A03DC0-EPOL LINK PLATE, 20A, 120/1, GFCI, NEMA 5-20R DUPLEX
1 EA ASSEMBLY PARTS-EPOL STANDARD ELECTRA POLE ACCESSORIES

ITEM J09.2 - POWER POLE (1 REQ'D)
SIS No.: *E024

Avtec Model ELECTRA POLEM
1 EA ELECTRA-POLE-EPOL ELECTRA POLE
2 EA LI20A03DC0-EPOL LINK PLATE, 20A, 120/1, GFCI, NEMA 5-20R DUPLEX
2 EA LX30A03AR0-EPOL LINK PLATE, 30A, 120/1, NEMA 5-30R ST. BL., W/BREAKER
1 EA ASSEMBLY PARTS-EPOL STANDARD ELECTRA POLE ACCESSORIES

ITEM K01 - UNDERMOUNT S/S HAND SINK (1 REQ'D)
SIS No.: *E024

BK Resources Model BKFB-1410-8-14 Dimensions: 14(h) x 10(w) x 8(d)
Weld-In Sink, one compartment, 14"W x 10"D x 8" deep, 3/4" covered corners, bottom crowned to 3-1/2" embossed opening, slope drain, interior seams polished, exterior seams unpolished, 14/304 stainless steel construction, NSF C2

ITEM K01.1 - DECK-MOUNTED GOOSENECK FAUCET (1 REQ'D)
SIS No.: *E024

T&S Brass Model B-1141-XS
Faucet, gooseneck nozzle, deck mount, 2" IPS shanks for mounting on thicker surfaces, quarter-turn Eterna cartridges, lever handles, low lead, ADA Compliant
1 kt Model B-1100-KIT 24" Inlet Supply Hoses (3/8" Compression x 1/2" NPSM Female)

ITEM K01.2 - DROP-IN SOAP DISPENSER (1 REQ'D)
SIS No.: *E024

AllPoints Foodservice Parts & Supplies Model 1411144
Bobrick Liquid Soap Dispenser, 34 oz. plastic globe, mounts in deck up to 4" thick, corrosion resistant valve, stainless steel spout rotates 360°

ITEM K01.3 - DROP-IN PAPER TOWEL DISPENSER (1 REQ'D)
SIS No.: *E024

Bobrick Washroom Model B-526
Satin-finish stainless steel. Flange has 90° return. Towels load into top of dispenser. Dispenses 300 C-fold or multifold towels. Unit 12 ¾" W, 6" front to back depth (325 x 150mm); 17" (430mm) min. clearance below mounting surface is required. Rough Countertop Cutout: 12 ¼" W (310mm), 4 ½" front to back depth (115mm), ¾" to 1 ½" (19 to 38mm) mounting thickness. Housing below countertop to conceal dispenser is not included.

ITEM K01.4 - SPLASH GUARD (2 REQ'D) <Included>
SIS No.: *E024

Vollrath Model CUSTOM
Part of Item # K01

ITEM K02 - MILLWORK COUNTER (1 REQ'D)
SIS No.: *E024

Custom Model CUSTOM
Snack Counter, size & shape per plan
Refer to Architectural Drawings for Finishes & Details
3cm Quartz Top w/4" tall Quartz Splashes at walls
Premium Laminate on exterior of Cabinetry & Fixed Toe Kick
White Melamine interior of Cabinetry
Laminated adjustable midshelf in each cabinet
Locking Hinged Doors
All locks master keyed
Fully enclosed recess with no floor for Trash Compartment
Stopper at rear of Trash Container to ensure alignment with Trash Ring
Trash Compartment Door to have integrated Toe Kick with 1/2" gap at bottom
Cut Out in Countertop for Trash Ring
S/S Trash Ring, 6" dia. x 4" height, polished with 1/2" flange/lip
FSEC to coordinate all cut out requirements with counter fabricator

1 ea	Provide shop drawings for review and approval prior to fabrication

ITEM K02.1 - TRASH RING (1 REQ'D)
SIS No.: *E024

Vollrath Model 3Y0502 Dimensions: 2(h)
Garbage Waste Chute, 6-9/16" x 2" deep, round, 22 gauge stainless steel, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

ITEM K03 - SLIDING GLASS DOOR REFRIGERATOR (1 REQ'D)
SIS No.: *E024

Atosa USA, Inc. Model MCF8727GR Dimensions: 81.2(h) x 54.4(w) x 29.7(d)
Refrigerator Merchandiser, two-section, 54-2/5"W x 29-7/10"D x 81-1/5"H, bottom-mounted self-contained refrigeration, 44.9 cu. ft., (2) sliding glass doors, Dixell electronic controller, 33° to 40°F temperature range, (8) shelves, LED interior lighting, lighted header panel, stainless steel interior, black steel exterior, 2" casters, R290 Hydrocarbon refrigerant, 1/4 HP, 115v/60/1-ph, 4.2 amps, cord, NEMA 5-15, cETLus, ETL-Sanitation

1 ea	2 year labor & parts warranty, 5 years warranty on compressor (continental USA only)

ITEM K04 - GLASS DOOR FREEZER (1 REQ'D)
SIS No.: *E024

True Mfg. - General Foodservice Model GDM-26F-HC~TSL01 Dimensions: 78.63(h) x 30(w) x 29.88(d)
Freezer Merchandiser, one-section, True standard look version 01, -10°F, (4) shelves, (1) triple-pane thermal glass hinged door, LED interior lights, powder coated steel exterior, white interior with stainless steel floor, R290 Hydrocarbon refrigerant, 1 HP, 115v/60/1-ph, 9.5 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA

1 ea	7 year compressor warranty, 7 years parts warranty, 7 year labor warranty, standard. Visit www.truemfg.com for specifics.
1 ea	Self-contained refrigeration standard
1 ea	Exterior: Black powder coated steel
1 ea	Interior: White aluminum, with white shelving, standard
1 ea	Door hinged right standard
1 ea	Sign, Plain Black in lieu of standard

ITEM S01 - 5-TIER WIRE SHELVING UNIT (7 kt REQ'D)
SIS No.: *E024

Quantum Model WR74-2436C-5 Dimensions: 74(h) x 36(w) x 24(d)
Wire Shelving Starter Kit, 36"W x 24"D x 74"H, 600 - 800 lb. capacity, includes (5) wire shelves & (4) posts, chrome plated finish, NSF, shipped KD
7 kt 1 year limited warranty for dry storage (limited against rust and corrosion)
7 st Model WR-00H Casters, set of (4) 5" swivel (2 with brakes), thermoplastic resin

ITEM S02 - 5-TIER WIRE SHELVING UNIT (43 kt REQ'D)
SIS No.: *E024

Quantum Model WR74-2448C-5 Dimensions: 74(h) x 48(w) x 24(d)
Wire Shelving Starter Kit, 48"W x 24"D x 74"H, 600 - 800 lb. capacity, includes (5) wire shelves & (4) posts, chrome plated finish, NSF, shipped KD
43 kt 1 year limited warranty for dry storage (limited against rust and corrosion)
43 st Model WR-00H Casters, set of (4) 5" swivel (2 with brakes), thermoplastic resin

ITEM S03 - 5-TIER WIRE SHELVING UNIT (13 kt REQ'D)
SIS No.: *E024

Quantum Model WR74-2460C-5 Dimensions: 74(h) x 60(w) x 24(d)
Wire Shelving Starter Kit, 60"W x 24"D x 74"H, 600 - 800 lb. capacity, includes (5) wire shelves & (4) posts, chrome plated finish, NSF, shipped KD
13 kt 1 year limited warranty for dry storage (limited against rust and corrosion)
13 st Model WR-00H Casters, set of (4) 5" swivel (2 with brakes), thermoplastic resin

ITEM S04 - DUNNAGE RACK (7 REQ'D)
SIS No.: *E024

Cambro Model DRS360480 Dimensions: 12(h) x 36(w) x 21(d)
S-Series Dunnage Rack, slotted top, 1500 lb. load capacity, 21"D x 36"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF, Made in USA

ITEM S05 - DUNNAGE RACK (1 REQ'D)
SIS No.: *E024

Cambro Model DRS480480 Dimensions: 12(h) x 48(w) x 21(d)
S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 48"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF, Made in USA

ITEM S06 - 4-TIER WIRE SHELVING UNIT (1 kt REQ'D)
SIS No.: *E024

Quantum Model WR63-2436C Dimensions: 63(h) x 36(w) x 24(d)
Wire Shelving Starter Kit, 36"W x 24"D x 63"H, 600 - 800 lb. capacity, includes (4) wire shelves & (4) posts, chrome plated finish, NSF, shipped KD
1 kt 1 year limited warranty for dry storage (limited against rust and corrosion)

1 st Model WR-00H Casters, set of (4) 5" swivel (2 with brakes), thermoplastic resin

ITEM S07 - CORNER GUARD (26 REQ'D)
SIS No.: *E024

BK Resources Model CG-248
Wall Corner Guard, 2"x 2"x 48", outside corner, 16 ga stainless steel

ITEM W01 - 23 GALLON TRASH CONTAINER (GRAY) (16 REQ'D)
SIS No.: *E024

Winco Model PTC-23SG Dimensions: 29.88(h) x 20.13(w) x 10.88(d)
Slender Trash Can, 23 gallon, 20-1/8”L x 10-7/8”W x 29-7/8”H, HDPE, gray (lid not included) (Qty Break = 1 each)
16 ea Model PTCL-23 Cover, for PTC-23SG, polypropylene, gray (Qty Break = 4 each)

ITEM W02 - 23 GALLON TRASH CONTAINER (GRAY) (8 REQ'D)
SIS No.: *E024

Winco Model PTC-23SG Dimensions: 29.88(h) x 20.13(w) x 10.88(d)
Slender Trash Can, 23 gallon, 20-1/8”L x 10-7/8”W x 29-7/8”H, HDPE, gray (lid not included) (Qty Break = 1 each)
8 ea Model PTCL-23 Cover, for PTC-23SG, polypropylene, gray (Qty Break = 4 each)

ITEM X01 - MULTIFUNCTION SKILLET (1 REQ'D) <Existing>
SIS No.: *E024

RATIONAL Model IVARIOPRO 2-XS 208/240V 3PH (LMX100AE)
FSEC to relocate per plan

ITEM X01.1 - WATER FILTER (1 REQ'D) <Existing>
SIS No.: *E024

RATIONAL Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X02 - ELECTRIC COMBI OVEN (1 REQ'D) <Existing>
SIS No.: *E024

RATIONAL Model ICP 6-FULL
FSEC to relocate per plan

ITEM X02.1 - WATER FILTER (1 REQ'D) <Existing>
SIS No.: *E024

RATIONAL Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X03 - HOT DOG CART (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X04 - 3-DOOR REACH-IN REFRIGERATOR (2 REQ'D) <Existing>
SIS No.: *E024

True Mfg. - General Foodservice Model T-72-HC
FSEC to relocate per plan

ITEM X05 - VACUUM PACKING MACHINE (1 REQ'D) <Existing>
SIS No.: *E024

Waring Model WCV300 Dimensions: 13.13(h) x 17.63(w) x 19.63(d)
FSEC to relocate per plan

ITEM X06 - SOUS VIDE SYSTEM (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X07 - 3-DOOR WORK TOP REFRIGERATOR (1 REQ'D) <Existing>
SIS No.: *E024

Everest Refrigeration Model ETBR3
FSEC to relocate per plan

ITEM X08 - WOK RANGE (1 REQ'D) <Existing>
SIS No.: *E024

American Range Model ARCR-31
FSEC to relocate per plan

ITEM X09 - 36"W REFRIGERATED BASE (3 REQ'D) <Existing>
SIS No.: *E024

Everest Refrigeration Model ECB36D2
FSEC to relocate per plan

ITEM X10 - COFFEE BREWER (1 REQ'D) <Existing>
SIS No.: *E024

BUNN Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X11 - COUNTERTOP 20 QT. MIXER (1 REQ'D) <Existing>
SIS No.: *E024

Hobart Model HMM20-1STD
FSEC to relocate per plan

ITEM X12 - ICE MACHINE (1 REQ'D) <Existing>
SIS No.: *E024

Scotsman Model CO33OMA-1D
FSEC to relocate per plan

ITEM X12.1 - ICE BIN (1 REQ'D) <Existing>
SIS No.: *E024

Scotsman Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X13 - INGREDIENT BIN (8 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X14 - WORKTOP REFRIGERATOR (1 REQ'D) <Existing>
SIS No.: *E024

True Mfg. - General Foodservice Model TWT-72-HC Dimensions: 33.38(h) x 72.38(w) x 30.13(d)
FSEC to relocate per plan

ITEM X15 - 5 QT. MIXER (8 REQ'D) <Existing>
SIS No.: *E024

KitchenAid Commercial Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X16 - COUNTERTOP INDUCTION RANGE (1 REQ'D) <Existing>
SIS No.: *E024

Winco Model ECIS-18C
FSEC to relocate per plan

ITEM X17 - COUNTERTOP INDUCTION RANGE (1 REQ'D) <Existing>
SIS No.: *E024

Globe (Middleby) Model GIR18 Dimensions: 6(h) x 15(w) x 19(d)

FSEC to relocate per plan

ITEM X18 - 60 QT. MIXER (1 REQ'D) <Existing>
SIS No.: *E024

Eurodib USA Model M60A 220ETL Dimensions: 56(h) x 24(w) x 40(d)
FSEC to relocate per plan

ITEM X19 - 20-QT MIXER (1 REQ'D) <Existing>
SIS No.: *E024

Prestoware Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X20 - WOOD TOP TOOL CABINET (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X21 - REFRIGERATED PREP TABLE (1 REQ'D) <Existing>
SIS No.: *E024

Delfield Model 448N-12
FSEC to relocate per plan

ITEM X22 - REFRIGERATOR, REACH-IN, GLASS DOOR (1 REQ'D) <Existing>
SIS No.: *E024

Beverage Air Model HBR27HC-1-HG Dimensions: 84.12(h) x 30(w) x 33.5(d)
FSEC to relocate per plan

ITEM X23 - 3-TIER HYDROPONICS UNIT (66" X 33 X 81") (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X24 - HOLDING AND TRANSPORT CABINET (2 REQ'D) <Existing>
SIS No.: *E024

Vulcan Model VHFA18 Dimensions: 71(h) x 25.25(w) x 30.75(d)
FSEC to relocate per plan

ITEM X25 - DOUGH DIVIDER (18-1/4" X 21-1/2" X 67") (1 REQ'D) <Existing>
SIS No.: *E024

Dutchess Bakers Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X26 - CAN RACK (25-3/4" X 24" X 33-1/2") (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X27 - CAN RACK (26-1/2" X 38" X 82-1/2") (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

ITEM X28 - FOOD PROCESSOR (1 REQ'D) <Existing>
SIS No.: *E024

To Be Verified Model TO BE VERIFIED
FSEC to relocate per plan

END OF SECTION 11 40 00

SECTION 11 60 00 – HIGH PERFORMANCE FUME HOODS

PART 1- GENERAL

1.01 SUMMARY

A. Section Includes:
   1. High Performance Laboratory fume hoods.

B. Related Sections Includes:
   1. 12 34 50 “Wood Laboratory Furniture”
   2. Division 23 “Mechanical”

1.02 FUME HOOD GENERAL DESIGN REQUIREMENTS

A. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.

B. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.

C. Average illumination of work area with white liner: Minimum 80 foot-candles. Work area shall be defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches.

D. Fume hood shall be designed to minimize static pressure loss with adequate slot area. Maximum average static pressure loss readings taken three diameters above the hood outlet from four points, 90 degrees apart, shall not exceed the following maximums with sash in full open position:

Face Velocity	Measured S.P.L. (W.G.)
52 F.P.M.	.19 inches

E. Fume hoods shall be available in standard widths of 4, 5, 6 & 8-feet. Each size will have this depth available: 35.25”.

F. Noise Criteria: Test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Reading taken 3' in front of an open sash at the 18” operational height at 100 fpm face velocity.

1.03 LINER SURFACE FINISH PERFORMANCE REQUIREMENTS

A. Test procedure:
   1. Test No. 1 – Spills and Splashes:
      1.1 Suspend in a vertical plane a 42” (horizontal) by 12” (vertical) panel divided

into 3/4" wide vertical columns, each column numbered 1 through 49.
1.2 Apply five drops of each reagent listed with an eye dropper.
1.3 Apply liquid reagents at top of panel and allow to flow down full panel height. (CAUTION! Flush away any reagent drops.)

2. Test No. 2 – Fumes and Gases:
2.1 Divide 24" x 12" panel into 2" squares, each square numbered 1 through 49.
2.2 Place 25 milliliters of reagent into 100 milliliters beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.
3. After 24 hours remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.

B. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:
1. No Effect: No detectable change in surface material.
2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.

C. Test Results: Fume Hood Liner

REAGENT LIST Concentrations by Weight	Test No. 1 Rating Spills	Test No. 2 Fumes
1. Sodium Hydroxide Flake	---	No Effect
2. Sodium Hydroxide, 40%	Excellent	No Effect
3. Sodium Hydroxide, 20%	Excellent	No Effect
4. Sodium Hydroxide, 10%	Excellent	No Effect
5. Ammonium Hydroxide, 28%	No Effect	No Effect
6. Eldorado - Plus (Solution)	No Effect	No Effect
7. Chloroform	Excellent	No Effect
8. LpH SE (Solution)	No Effect	No Effect
9. Trichloroethylene	Excellent	No Effect
10. Monochlorobenzene	Excellent	No Effect
11. Tincture of Iodine	Excellent	Excellent
12. Methyl Alcohol	No Effect	No Effect
13. Ethyl Alcohol	No Effect	No Effect
14. Butyl Alcohol	No Effect	No Effect
15. Phenol, 85%	Excellent	No Effect
16. Cresol	Excellent	No Effect
17. Sodium Sulfide, Saturated	Good	No Effect
18. Furfural	Fair	No Effect
19. Dioxane	No Effect	No Effect
20. Zinc Chloride, Saturated	No Effect	No Effect
21. Benzene	Excellent	No Effect
22. Toluene	Excellent	No Effect
23. Xylene	Excellent	No Effect

24.	Gasoline	Excellent	No Effect
25.	Naphthalene	Excellent	No Effect
26.	Methyl Ethyl Ketone	Excellent	No Effect
27.	Acetone	Excellent	No Effect
28.	Ethyl Acetate	Excellent	No Effect
29.	Amyl Acetate	Excellent	No Effect
30.	Ethyl Ether	Excellent	No Effect
31.	Silver Nitrate, 10%	Good	No Effect
32.	Di Methyl Formamide	No Effect	Excellent
33.	Formaldehyde, 37%	No Effect	No Effect
34.	Formic Acid, 88%	No Effect	No Effect
35.	Acetic Acid, Glacial	No Effect	No Effect
36.	Dichloro Acetic Acid, 93%	Excellent	Excellent
37.	Chromic Acid, Saturated	Good	No Effect
38.	Phosphoric Acid, 85%	No Effect	No Effect
39.	Sulfuric Acid, 33%	No Effect	No Effect
40.	Sulfuric Acid, 77%	Excellent	No Effect
41.	Sulfuric Acid, 93%	Good	No Effect
42.	Hydrogen Peroxide, 30%	No Effect	No Effect
43.	Acid Dichromate	Excellent	No Effect
44.	Nitric Acid, 20%	Excellent	No Effect
45.	Nitric Acid, 30%	Excellent	No Effect
46.	40 & 47 Equal Parts	Excellent	Good
47.	Nitric Acid, 70%	Excellent	Good
48.	Hydrochloric Acid, 37%	No Effect	Excellent
49.	Hydrofluoric Acid, 48%	No Effect	Failure

1.04 SUBMITTALS

A. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances and all required clearances.

B. Product Data: Submit manufacturer's data for each component and item of laboratory equipment specified. Include component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations. Include liner and exterior finish tests by independent third party.

1.05 QUALITY ASSURANCE

A. Single source responsibility: Fume hood casework, work surfaces, and other laboratory equipment and accessories shall be manufactured or furnished by a single laboratory furniture company.

B. Manufacturer's qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:
   1. Five years or more experience in manufacture of laboratory casework and equipment of type specified.
   2. Ten installations of equal or larger size and requirements.
   3. UL 1805 Specification:
      Fume Hood must be Underwriters Laboratories subject 1805 classified. The 1805 standard covers electrical and mechanical hazards, investigate the

flammability of materials and measures the effectiveness of airflow characteristics. Proper labeling must be affixed to the face of each fume hood indicating classification to the UL 1805 standard for Laboratory Fume Hoods. UL listing covering electrical components only or other listings that do not encompass all issues covered in UL 1805 is insufficient. All factory testing shall be performed in a U.L. certified test facility.

1.06 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.

B. Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.

1.07 PROJECT CONDITIONS

A. Do not deliver or install equipment until the following conditions have been met:
1. Windows and doors are installed and the building is secure and weather tight.
2. Ceiling, overhead ductwork and lighting are installed.
3. All painting is completed and floor tile located below casework is installed.

PART 2- PRODUCTS

2.01 MANUFACTURER

A. Casework, fume hood and equipment manufacturer: BMC, P.O. Box 4089, Muskegon, MI 49444, 231-733-1206.
B. Basis of Design- Airfoil ADA Assemblies hoods 60” model with Allen Bradley, model number 600TQX216 motor starter switch.

2.02 FUME HOOD MATERIALS

A. Steel: High quality, cold rolled, mild steel meeting requirements of ASTM A366; gauges U.S. Standard.

B. Stainless steel: Type 304; gauges U.S. Standard.

C. Ceiling closure panels: Minimum 18 gauge; finish to match hood exterior.

D. Safety glass: 7/32" thick laminated safety glass.

E. Sash cables: Stainless steel, uncoated, 1/8" diameter military spec. quality. (MIL-W-83420D-3)

F. Sash guides: Corrosion resistant poly-vinyl chloride.

G. Pulley assembly for sash cable: 2" diameter, nylon race, ball bearing type, with cable retaining device and sash leveling mechanism.

H. Sash pull: Full width extruded aluminum with chemical resistant powder coating.

I. Gaskets: Ridged black PVC for interior access panels. Gasket shall retain access panels with integral clips for easy removal and replacement of panel.

J. Fastenings:
1. Exterior structural members attachments: 1/4-20 machine screws and lock nuts, zinc plated.
2. Interior fastening devices concealed. All fasteners exposed to the hood interior shall be non-metallic.
3. Exterior side access panel member fastening devices to be concealed. Mechanical latch, exposed screws or velcro type fasteners – not acceptable.

K. Instruction plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information covering recommended locations for apparatus and accessories, baffle settings and use of sash.

L. Resin-Chem: White chemical resistant, fiberglass reinforced thermostat resin sheet. Flame spread rating; 25.

2.03 FUME HOOD CONSTRUCTION

A. Superstructure: Rigid, self supporting assembly of double wall construction, maximum 5" thick.
1. Wall consists of a sheet steel outer shell and a corrosion resistant inner liner, and houses and conceals steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Panels must be attached to a full frame construction, minimum 16 gauge painted members.
2. Access to fixture valves concealed in wall provided by exterior removable access panels and gasketed access panels on the inside liner walls.

B. Exhaust outlet: Round, 18 gauge stainless steel.

C. Access opening perimeter: Air foil or streamlined shape with all right angle corners radiused. Bottom horizontal foil shall be double tiered and provide nominal one inch bypass when sash is in the closed position. Bottom foil shall not be removable without use of special tools. Bottom foil shall provide access area sufficient in size to pass thru electrical plugs. Bottom foil: Steel with powder coated finish.

D. Fume hood sash: (Combination) Vertical and horizontal sash access with a 35” high sight line. Sash shall be top hung on nylon tired ball bearing wheels. Sash side frame must be inset into sash guides providing a full width unobstructed view of the interior. Exposed side frames - not acceptable. Upper and lower sash frame components to be extruded aluminum. Lower frame radiused to minimize turbulence and have integral guides for horizontal sliding panels. Area above the 27 1/2” vertical sash opening shall be glazed with laminated safety glass. All glass to have finished edge treatment. Horizontal panels provided with finger pulls.

E. Counter balance system: Single weight, pulley, cable, counter balance system which prevents sash tilting and permits one finger operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure.

F. Sash lock: Keyed sash lock to prevent the sash from opening above 18” without being

unlocked. Sash shall be able to be locked at any position, even above 18”, and reset when lowered below 18”.

F. Airfoil: The airfoil will be flush to the worksurface with ample room for electrical cords to fit between the airfoil and sash handle. Sill to be aerodynamically radiused on front edge and have a secondary containment trough.

G. Fume hood liner: Resin-chem: Reinforced polyester panel; smooth finish and white color in final appearance. Flexural strength: 19,500 psi. Flame spread: 19 or less per ASTM E84. Baffle must be same material as liner. Metallic baffles, brackets or supports on hood interior – not acceptable. Liner and baffle material must meet 1.03 performance test.

H. Baffles: Baffles providing controlled air vectors into and through the fume hood must be fabricated of the same material as the liner. High performance baffles must be mathematically calculated to provide proper energy distribution of exhaust currents providing stable performance regardless of sash position. Baffle to be non-adjustable. Baffles with manual or automatic adjustment are not acceptable. All baffles, supports, and brackets to be non-metallic.

I. Sash Position: Sash shall be designed to promote usage as an upper body and face shield. Face velocities and volumes shall be based on an 18” operating opening. Sash shall have the capability to be raised to full 27.5” vertical opening for loading or unloading of large apparatus. A keyed lock shall be provided limiting the sash operation to 18”.

J. Service fixtures and fittings: Color coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color coded index buttons.
1. Valves: Needlepoint type with self-centering cone tip and seat of hardened stainless steel. Tip and seat shall be removable and replaceable.
2. Provide piping for all service fixtures from valve to outlet and from valve to a point 3” above or below the superstructure as indicated by project conditions: Copper for water, air and vacuum and black iron for gas services.
3. Fixtures exposed to hood interior: Color coded chemically resistant nylon.
4. Remote control handles: Black nylon four-arm handle with nylon color-coded index buttons.
5. Services: As shown or specified.

K. Hood light fixture: Two lamp, instant start, UL listed, T8 fluorescent light fixture with sound rated “A” ballast installed on exterior of roof. Provide safety glass panel cemented and sealed to the hood roof.
1. Interior of fixture: White, high reflecting plastic enamel.
2. Size of fixture: Largest possible up to 48" for hoods with superstructures up to six feet. Provide two 24" fixtures for hoods with eight foot superstructures.
3. Include lamps with fixtures. Hoods without lamps – not acceptable.
4. Illumination: Per performance values, Part 1 of this Section.
5. Access to light from top front of hood.

L. Electrical services: Three wire grounding type receptacles rated at 120 V.A.C. at 20 amperes. Flush plates: Stainless steel.

M. Wiring: Pre-wire electrical fixtures to junction box located on top of hood.

N. Work surfaces: 1-1/4" thick surface, dished a nominal 3/8” to contain spills.

1. Molded resin work surfaces for hoods with Resin-Chem liners.

O. Safety Monitor/Alarm System: [Specified's Option]
Where shown or specified provide Safety Monitor/Alarm System which monitors face velocity and provides audible and visual alarm if face velocity drops below safe levels. The technology used in the alarm will be based on thermally compensated thermistor based in the alarm module.
1. Safety monitor: UL listed, tamper proof, with all alarm circuits, electric components, external tubing, and manifolds furnished complete and factory installed. The monitor shall have a visual display which provides clear indication of airflow conditions.
2. Calibration is the responsibility of the owner and is required once the hood is stationed and the hood exhaust and room supply systems are balanced. A secondary calibration has been factory set into the alarm's memory only to determine that the alarm is functional and ready for shipment. The primary calibration must be completed in the field.
3. Airflow sensor: Thermally compensated glass-beaded thermistor, factory connected to a side-wall port on the interior of the fume hood.
4. Alarm Signal: Audible and visual signal:
4.1 Silence pushbutton, which disables the audible alarm, shall be accessible on the front of the safety monitor.
4.2 When alarm condition is corrected and face velocity and volume return to specified levels, the Safety Monitor will automatically reset and begin routine monitoring.
5. Provide test circuit to verify proper Safety Monitor operation.
6. Electrical rating: Maximum 12 VDC.

2.04 METAL FINISH

A. Metal finish:
1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pre-treat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
2. Application: Electrostatic application of epoxy powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high-grade laboratory furniture quality finish with a 1.5 mil average thickness.

B. Surface Finish Tests:
Independent, third party performance testing must be submitted validating compliance and adheres to the finish specifications.
1. Chemical Spot Test:
1.1 Purpose of Test
The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

1.2 Test Procedure
Obtain one sample panel measuring 14" x 24" (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein.

Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73+ 3F (23(+ 2(C) and 50+ 5% relative humidity. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods:

Method A – Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a one-ounce (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B – Test volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naphtha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73±3°F (23°±2°C) and 50±5% relative humidity using the following rating system:

Level 0 – No detectable change.
Level 1 – Slight change in color or gloss.
Level 2 – Slight surface etching or severe staining.
Level 3 – Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	A
2.	Acetate, Ethyl	A
3.	Acetic Acid, 98%	B
4.	Acetone	A
5.	Acid Dichromate, 5%	B
6.	Alcohol, Butyl	A
7.	Alcohol, Ethyl	A
8.	Alcohol, Methyl	A
9.	Ammonium Hydroxide, 28%	B
10.	Benzene	A
11.	Carbon Tetrachloride	A
12.	Chloroform	A
13.	Chromic Acid, 60%	B
14.	Cresol	A
15.	Dichlor Acetic Acid	A
16.	Dimethylformanide	A
17.	Dioxane	A
18.	Ethyl Ether	A
19.	Formaldehyde, 37%	A
20.	Formic Acid, 90%	B
21.	Furfural	A
22.	Gasoline	A
23.	Hydrochloric Acid, 37%	B
24.	Hydrochloric Acid, 48%	B
25.	Hydrogen Peroxide, 3%	B
26.	Iodine, Tincture of	B
27.	Methyl Ethyl Ketone	A
28.	Methylene Chloride	A

29.	Mono Chlorobenzene	A
30.	Naphthalene	A
31.	Nitric Acid, 20%	B
32.	Nitric Acid, 30%	B
33.	Nitric Acid, 70%	B
34.	Phenol, 90%	A
35.	Phosphoric Acid, 85%	B
36.	Silver Nitrate, Saturated	B
37.	Sodium Hydroxide, 10%	B
38.	Sodium Hydroxide, 20%	B
39.	Sodium Hydroxide, 40%	B
40.	Sodium Hydroxide, Flake	B
41.	Sodium Hydroxide, Saturated	B
42.	Sulfuric Acid, 33%	B
43.	Sulfuric Acid, 77%	B
44.	Sulfuric Acid, 96%	B
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	B
46.	Toluene	A
47.	Trichloroethylene	A
48.	Xylene	A
49.	Zinc Chloride, Saturated	B

1.3 Acceptance Level
Results will vary from manufacturer to manufacturer. Laboratory grade finishes should result in no more than four Level 3 conditions. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

2. Hot Water Test
   2.1 Purpose of Test
   The purpose of this test is to insure the coating is resistant to hot water.
   2.2 Test Procedure
   Hot water, 190°F to 205°F (88°C to 96°C), shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.44cc) per minute on the surface, which shall be set at an angle of 45-degrees, for a period of five minutes.
   2.3 Acceptance Level
   After cooling and wiping dry, the finish shall show no visible effect from the hot water.
3. Impact Test
   3.1 Purpose of Test
   The purpose of this test is to evaluate the ductility of the coating.
   3.2 Test Procedure
   A one-pound ball approximately 2" (50.8mm) in diameter shall be dropped form a distance of 12" (304.8mm) onto a flat horizontal surface, coated to manufacturer’s standard manufacturing method.
   3.3 Acceptance Level
   There shall be no visible evidence to the naked eye of cracks or checks in the finish due to impact.
4. Paint Adhesion on Steel Test
   4.1 Purpose of Test
   The paint adhesion test is used to determine the bond of the coating to steel. This does not apply to non-steel products.

4.2 Test Procedure
This test is based on ASTM D2197-86 “Standard Method of Test for Adhesion of Organic Coating”. Two sets of eleven parallel lines 1/16" (1.587mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush for one minute. Examine under 100-foot candles of illumination.
4.3 Acceptance Level
Ninety or more of the squares shall show finish intact.

5. Paint Hardness on Steel Test
5.1 Purpose of Test
The paint hardness test is used to determine the resistance of the coatings to scratches.
5.2 Test Procedure
Pencils, regardless of their brand, are valued in this way: 8-H is the hardest, and next 11 order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which are softest). The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one, that is the hardest pencil that will not rupture the film, is then used to express or designate the hardness.
5.3 Acceptance Level
The paint shall have a hardness of 4-H minimum.

2.05 SOURCE QUALITY CONTROL TESTING OF FUME HOODS

A. Evaluation of manufacturer's standard product shall take place in manufacturer's own test facility, with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer at no cost to the Owner.

B. Submit test report consisting of the following test parameters and equipment for each hood width and configuration specified.

C. Hood shall achieve a rating of 4.0 AM 0.05 PPM or better. Tested to ASHRAE-110-1995. Test shall be done with sash open 27.5” vertically at 52 fpm face velocity.

D. Test facility: Sufficient size to provide unobstructed clearance of five feet each side and ten feet in front of fume hood. Provide make-up air to replace room air exhausted through fume hood and to obtain a negative 0.2" w.g. room pressure. Introduce make-up air in a manner that minimizes drafts in front of hood to less than 20% of the face velocity.

1. Examine facility to verify conformance to the requirements of this Section.
2. Test room shall be isolated from all personnel during test procedure.

E. Testing equipment:
1. Properly calibrated hot wire thermal anemometer probes equal to Alnor AVT-55; correlate with computer data acquisition format to provide simultaneous readings at all points.
2. Pitot tube manometer with graduations no greater than 0.2 inch of water.
3. Tracer gas: Sulfur hexa-fluoride supplied from a cylinder at a test flow rate of four liters per minute.
4. Ejector system: Tracer gas ejector equal to ASHRAE-110-1995 specification.
5. Critical orifice: Sized to provide tracer gas at four liters per minute at an

upstream pressure of 30 PSIG.

6. Detection instruments: Qualitek Model Q200 Leak Meter sulfur hexa-fluoride detector instrument or equal.
7. Recorder with an accuracy better than plus or minus 0.5% of full scale.
8. Three dimensional manikin, overall height 67", clothed in a smock.
9. Titanium tetrachloride glass modules.
10. One dozen 30-second smoke bombs.

F. Preliminary Test and Data:
1. Provide sketch of room indicating room layout, location of significant equipment, including test hood and other hoods. Provide sketch of air supply system indicating type of supply fixtures.
2. Reverse air flows and dead space:
2.1 Swab strip of titanium tetrachloride along both walls and floor of hood in a line 6" behind and parallel to the hood face, and along the top of the face opening. Swab an 8" diameter circle on the back of the hood. All smoke should be carried to the back of the hood and exhausted.
2.2 Test the operation of the bottom air bypass air foil by running the cotton swab under the air foil.
2.3 If visible fumes flow out of the front of the hood, the hood fails the test and receives no rating.
3. Face velocity measurements: Face velocity shall be determined by averaging minimum of four and maximum of eight readings at the hood face. Take readings at center of a grid made up of sections of equal area across the top half of the face and sections of equal area across the bottom half of the face. Take simultaneous readings at each point with a series of calibrated hot wire anemometers over a one minute period of time. Probes shall be correlated to a computer data acquisition package, which will provide an average of each reading over that one minute period and also an overall average. During the one minute monitoring period, all velocities must automatically update average at a maximum of four second intervals.

G. Test Procedure:
1. Check sash operation by moving sash through its full travel. Verify that sash operation is smooth and easy, and that vertical rising sash shall hold at any height without creeping up or down. Position sash in the full open position.
2. Take a static pressure reading, using methods assuring an accurate reading, in an area of the ductwork no more than three feet nor less than one foot above the exhaust collar. Static pressure loss shall not exceed values given under Design Requirements in Part 1 of this Section.
3. Install ejector in test positions. For a typical bench-type hood, three positions are required: left, center and right as seen looking into the hood. In the left position the ejector center line is 12" from the left inside wall of the hood; center position is equal distance from the inside sidewalls; and the right position is 12" from the right inside wall. The ejector body is 6" in from the hood face in all positions. Location of ejector may require modification for hoods of unusual dimensions.
4. Install manikin positioned in front of the hood, centered on the ejector.
5. Fix detector probe in the region of the nose and mouth of the manikin. Take care that method of attachment of the probe does not interfere with the flow patterns around the manikin. Locate nose of manikin 9" in front of ejector (3" in front of sash).
6. Open tracer gas block valve. Correlate readings with a computer data acquisition package, which is capable of monitoring and visually recording a

minimum of one reading per second for a minimal three minute time period at each of the three positions.

7. The control level rating of the hood shall be the maximum of the three average values for the three test positions.
8. Record performance rating of the fume hood as XXAMyyy, where XX equals the release rate in liters per minute (4.0) and AM represents the as manufactured test sequence and yyy equals the control level in parts per million.
9. All data on the above test conditions including instrumentation and equipment, test conditions, preliminary test and data information shall be provided on a report, including a printout of the average face velocities, and a separate graph-type performance curve on all three tracer gas positions.

PART 3- EXECUTION

3.01 INSTALLATION

A. Installation:
   1. Install fume hoods and equipment in accordance with manufacturer's instructions.
   2. Install equipment plumb, square, and straight with no distortion and securely anchored as required.
   3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

B. Accessory installation: Install accessories and fittings in accordance with manufacturer's recommendations.

3.02 ADJUSTING

A. Adjust sash, fixtures, accessories and other moving or operating parts to function smoothly.

3.03 CLEANING

A. Clean equipment, touch up as required.

3.04 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of equipment from exposure to other construction activity.

B. Advise contractor of procedures and precautions for protection of material and installed fume hoods from damage by work of other trades.

END OF SECTION 11 60 00

SECTION 11 62 01 – GYM PARTITION SAFETY SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Provide safety system for each fold-down gymnasium partition indicated on the drawings.

B. Provide all labor, materials, tools, hoists, transportation, equipment, apparatus, and all required appurtenances and incidental auxiliaries necessary for the installation of the system in a safe, substantial, workmanlike manner, complete in every detail, tested and ready for satisfactory operation.

C. The safety system shall be distributed and processed as an integrated and fully tested system for the purpose of providing moving partition door safety. Hardware assembled from various sources to serve the installation requirements is specifically unacceptable.

D. The safety system shall be compliant with New York State Education Department requirements and Commissioner's Regulation 155.25.

1.02 FOR REVIEW/APPROVAL

A. Product Data: Submit manufacturer's technical product data, including rated capacities, furnished components and accessories, and installation and start-up instructions.

B. Wiring Diagrams:

1. Ladder type wiring diagrams for interlock and control wiring.
2. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

C. Manufacturer's standard warranty.

D. Installation, Operation and Maintenance Manual.

1.03 SUBMITTALS – FOR CLOSEOUT

A. Maintenance Data:

1. Maintenance instructions and parts list including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. **nControl Gym System** by 10100 Inc
2. The “Safe Path System” by Gym Door Repairs, Inc., 685 Jericho Turnpike, Huntington Station, NY 11746, (631)-549-8745.

2.02 GENERAL

A. Provide two (2) key-operated, tamper-proof, constant pressure control stations that are wired in series, remotely located at opposite ends and opposite sides of, and in view of, the partition, and which are designed and constructed so as to require simultaneous activation of both control stations to operate the partition. Location to be determined by Architect

B. The electric device controlling the operation of the partition shall be capable of being reversed at any point in the extend, retract, or stack travel cycle.

C. Device(s) are provided for all partitions that will stop the motion of the partition when a body or object passes between the leading edge of such partition and a wall, floor, or other termination point. The devices typically include beam type sensors (with a sending device and a receiving device) or motion detection sensors on each side of the partition such that if the beam is broken or motion is detected the partition will stop movement prior to an occupant reaching the partition. The beam type sensors or motion detection sensors must be located such that it is not possible for an occupant to go over or under the beam(s) or avoid the motion detection range. Multiple sets of beam type sensors or motion detection sensors may be required on each side of the partition to achieve total coverage of the area. Note that the sole use of partition leading edge sensors that require physical contact is not adequate. Manual reset shall be required.

D. Signage must give notice regarding safe and proper operation and supervision of the electrical controls and partition/door pathway. The following suggested or similar wording for this notice must be posted at every control station:

CAUTION

ELECTRICALLY-POWERED PARTITION

Only Appropriately Trained Staff may operate this partition.

Control stations must be attended by staff members while the partition is in motion.

Staff members must stand on opposite sides of the opening or closing partition.

Students must stay away from the partition when in motion.

Signage Location to be determined by Architect

2.03 SYSTEM DESCRIPTION

A. The safety detection system shall be specifically designed for use on existing and new electrically operated folding/operable partitions. The safety detection system shall create an infra-red barrier at each side of the entire operation path, so that immediate shut down will occur if any person or object enters into the operating path. When an obstruction is detected, the movement of the door shall instantly and automatically stop, regardless of the direction the door is traveling and alarm shall sound. For continued operation of the folding door the system must be manually reset.

2.04 WORK INCLUDED

A. The contractor shall furnish all the necessary labor and materials, operations, equipment, and incidentals necessary to facilitate, erect, construct, install, calibrate, and finish the work as specified on accompanying drawings and this specification.

1. Furnish and install sufficient infrared sensing devices, with approved guards, to detect any personnel obstructions along the entire length of the path of the folding door, and no more than six (6)/no less than three (3) feet) to both sides, during opening and closing modes. Door pockets or equivalent stacking areas shall be considered separate with its own key switches though a latching relay in order to stop door system and reset with key switch.

    a. Passive Infrared Detectors (PIR) shall be capable of wall or ceiling surface mounting, self-contained, operating on 12 VAC input power and have adjustable internal optics. Optics shall be focused to provide the narrowest detection corridor adjacent to the doors that assures reliable detection. The operator control panel shall be positioned as close to the detection corridor as possible without causing the operator to cause an unintended detection/alarm.
    b. PIR guards shall be constructed of .135 diameter wire, die formed and electrically welded with hi-temperature baked white enamel finish or an approved equal. Guards shall be independently fastened to the wall or ceiling with at least four approved fastening devices.

2. Furnish and install a lockable system control panel (SCP) of suitable size, to house the following equipment:

    a. Terminal Strip of sufficient size, for each connection into panel.
    b. Complete circuit control board.
    c. Two (2) L.E.D. indicators mounted at cover.
    d. Resistors, resistor blocks and interwiring.
    e. Two (2) 12 VAC relay devices.
    f. SCP shall be located at nearest storage area and include coded security tag, sealing enclosure. The SCP shall not be in the athletics area.

3. Furnish and install a heavy duty motor solenoid relay of suitable size and characteristics in a vented, surface mounted box. Wire relay to control operation of gym door.
4. Furnish and install, in gym ceiling or door storage pocket area at ceiling level, one alarm warning device to be activated for 15 seconds when system senses any obstruction and stops the movement of door. Warning alarm device shall be Sound Bomb type PIEZO warning device alert with 100 db. output, with high and low tone settings or an approved equal. Wire this device to relay in S.C.P.

5. Furnish and install in a surface mounted, two gang box, with stainless steel face plate and tamper proof screws a manual, key operated arming and disarming switch with a red LED indicator for armed position and green LED indicator for AC power and one spring loaded, key operated, switch to control operation of moving door in both directions. The control box or boxes shall be located at a minimum distance of six (6) feet from outer edge of stacked panels/outer surfaces of extended panel face.
6. A prominent safety sign is to be provided at each control box location. (Sign text details see drawings.) Signs shall be of durable, metal construction, professional in manufacture and appearance, and securely fastened in place. The signs shall have minimum dimensions of 8½ inches by 11 inches and be of attention attracting colors.
7. Furnish and install all interwiring of suitable size, and raceways and make the proper connections to all items. Minimum size raceway for power shall be 3/4". All raceway shall be rigid steel and all conductors shall be in conduit or surface raceway.
8. Existing conduits (in retrofit projects) may be used where allowed by code and are suitably located. Flexible conduits may be used in concealed locations. Metal molding shall be utilized in offices or other staff occupied spaces. All raceway shall be painted with two coats of rust proof paint, the color to match surroundings.
9. All power wiring shall be THHN, minimum size #12. Low voltage wiring shall be 18 gauge, twisted, unshielded, copper, vinyl insulated, UL listed, plenum rated. Low voltage conductors shall not be placed in the same raceway, outlet box, junction box, or fitting containing electrical power, unless a suitable barrier is provided.
10. Upon completion, Contractor shall arrange for a demonstration of the system to be witnessed by Custodian, School Athletic Staff, Principal, Board of Education representative, Engineer and Construction Manager (if applicable).
11. Furnish School Staff with two (2) sets of keys for entire system and a set of operating instructions. Receive a signed receipt from school representative and submit with payment request.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the 2017 edition of the National Electrical Code and applicable state and local codes.

B. Coordinate the system installation with the folding partition manufacturer to avoid duplicate switches or other hardware, and to integrate the safety system with the partition electric system.

C. Select detailed switch and PIR sensor locations based on specifications of the safety system vendor.

END OF SECTION 11 62 01

SECTION 11 66 53 – GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gymnasium Divider Curtain – Roll Up

B. Related Sections
   1. Section 05 12 00 – Structural Steel Framing
   2. Section 05 21 00 – Steel Joist Framing
   3. Section 26 - Electrical

1.2 REFERENCES

A. ASTM E-84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Federal Standard 191 – Textile Test Methods.

C. NFPA 701 - Methods of Fire Tests for Flame-Resistant Textiles and Films.

D. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 ACTION SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures
   a. Certificates: Submit manufacturer's certificates for proof that all materials comply with specified requirements.
   b. Design Data: Submit manufacturer's design data, including loads to be transmitted to building structural members with requirements of any additional structure needed.
   c. Field Test Reporting: Submit manufacturer's certified destructive test reports completed by an accredited independent testing laboratory, indicating compliance with any specified factor or safety.
   d. Shop Drawings: Submit manufacturer's shop drawings, including elevations, plans, sections, layouts, component locations, dimensions, tolerances, fabrication details, materials, finish, quantities, hardware, fittings, electrical wiring diagrams, additional structure needed details, and method of attachment.
   e. Product Data: Submit manufacturer's product data, including proposed components, fabrication, finish, and materials.
   f. Samples: Submit manufacturer's color samples, including 18 ounce solid vinyl, 22 ounce solid vinyl, and 9 ounce vinyl mesh.

g. Installation Operation, and Maintenance Instructions: Submit installation, operation, and maintenance instructions including detailed step-by-step installation, troubleshooting, general operation instructions, and any recommended routine maintenance.
h. Warranty: Submit manufacturer's guarantees and warranty information on a system and/or component.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: All components to be provided from a single source manufacturer.

B. Installer Qualification: All components to be installed by a trained and qualified installer approved by the manufacturer.

C. Welding Certification: All welding to be completed by a certified welder in accordance to the American Welding Society (AWS), D1.1, "Structural Welding Code – Steel."

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver divider curtain in original manufacturer's containers, with all containers grouped together, with labels clearly labeling the manufacturer and contents. Upon delivery, immediately inspect delivery for any missing containers or damage. Any damage or defects shall be noted and reported to the Owner's Representative.

B. Storage: Store containers in a clean, dry indoor location.

C. Handling: Protect materials and finish during handling and installation.

D. Replacements: If necessary, replacements shall be immediately re-ordered, so as to minimize any conflict with the construction schedule.

1.6 WARRANTY

A. Curtain system shall be guaranteed against defects in material and workmanship for a period of one (1) year. Other components may be covered by their own extended warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Jaypro Sports, LLC. 976 Hartford Turnpike, Waterford, Connecticut 06385. Toll Free 800-243-0533. Phone 860-447-3001. Fax 800-988-3363. Email info@jaypro.com. Web www.jaypro.com.

B. Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
1. Nickerson Corporation
2. Manufacturers of equivalent products will be considered in accordance with Section 01 43 25 Product Substitution.

C. GYMNASIUM DIVIDER

1. Model Number: FC-680
2. Size: See drawings. Single continuous section.
3. Operation: Electrically operated, accordion style fold-up action.
4. Drive System: 1 HP, 110VAC 60hz Single-phase compensating type instantly reversible winch, direct drive, self lubricating gearing, with built-in POSILOK TM over-speed arrest system, and integral limit switches to control curtain travel.
5. Hoist Cables: 1/8" diameter aircraft cable, galvanized, 1800 pound break strength. Spaced 9'-3" on-center and 6" inward from curtain edges. Secured to top drive pipe and bottom batten. Cables constrained by cable spool guides on drive pipe to ensure straight and compact rolling action.
6. Fold Pattern:
   a. Symmetric: Hoist cables weaved through #4 metal grommets spaced 18" on-center to allow symmetric curtain fold balanced about the curtain centerline.
7. Drive Pipe: 2-3/8" outer diameter galvanized pipe supported by drive pipe carriers.
8. Configuration: Selected by Architect
9. Internal seams: All seams electronically RF welded vertically with 1" contact weld for resistance to tearing and breakaway.
10. Side Edges: Triple turned with double welds.
11. Curtain Top: 6" pocket supported from drive pipe carrier assemblies by No. 2/0 coil proof chain.
12. Curtain Bottom: 8" padded pocket formed with horizontal weld to conceal 1.66" outer diameter bottom batten pipe.
13. Attachment: Rigidly suspended from building structure with heavy duty clamp style fittings.
14. Control System: Wall mounted, three-position momentary contact key switch with polished wall plate located so the operator has full view of curtain during operation.
    a. Location to be determined by Architect.
15. Safety System: **See specification 11 62 01 Gym Partition Safety System**.
    a. Signage Location to be determined by Architect
    b. Two (2) key operated Control stations - Location to be determined by Architect

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas of installation for any conditions that would affect the installation of the gymnasium equipment. If conditions exist that prohibits or hinders installation, notify the Architect and do not proceed with the installation until conditions have been resolved.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install equipment level, straight, accurate in accordance with the supplied drawings and at the correct locations specified.

C. Install equipment with supplied hardware, fittings and components.

D. Take care to keep curtain fabric clean during install and not damage equipment or finish. Touch up finish if necessary.

3.3 ADJUSTING

A. Adjust gymnasium equipment as needed to function properly and to ensure accurate position in both stored and in-use positions.

3.4 CLEANING

A. Clean gymnasium equipment in accordance with manufacturer's instructions.

B. Do not use harsh cleaning methods or supplies that may alter the finish of the gymnasium equipment.

3.5 DEMONSTRATION

A. Demonstrate

B. Advise Owner Representative of operation procedure and required maintenance.

C. Furnish Owner Representative with means necessary to operate gymnasium equipment.

3.6 PROTECTION

A. For installations of gymnasium equipment with finished floor already installed, provide means of protecting the floor to prevent damage.

END OF SECTION 11 66 53.

SECTION 12 24 13 - ROLLER WINDOW SHADES

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 RELATED SECTIONS

A. Division 06 – Rough Carpentry: Wood blocking and grounds for mounting roller shades.

B. Division 09 – Gypsum Board

C. Division 09 – Acoustic Tile Ceilings

D. Division 26 – Electrical

1.3 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 70 - National Electrical Code.

C. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUMMARY

A. The work performed under this Section includes the performance criteria, materials, production, and erection of roller window shades for the project and consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all window shades as required by schedules, keynotes and drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction including, but not limited to the following:
   1. Manually operated roller shades with single rollers at all exterior windows of instructional spaces, including but not limited to, classrooms, conference rooms and offices and all interior door glazing and sidelites.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Manual Roller Shades with chain pull.

C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

F. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than ten units.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.

B. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

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

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide:
- Mechoshade Systems, Inc. – Mecho/5 Regular Roll Shade in 4133 Pocket manually operated single roller with Thermoveil screens - 1500 Series 3 % density at all interior classrooms doors with lites and/or sidelites, support space doors with lites and/or sidelites and, and all corridors windows. Shades are not required at exterior operable doors.

- Mechoshade System, Inc. – Mecho/5 Regular Roll in 5113 Pocket manually operated double roller shade with Thermoveil 1500 Series 3% density and 0100 Series Blackout at all science labs and prep rooms exterior windows.

Or comparable product by one of the following:

1. BTX Window Automation, Inc.
2. DFB Sales.
3. Draper Inc.
4. Hunter Douglas Contract.
5. Lutron Electronics Co., Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As directed during shop drawing review.
2. Direction of Shadeband Roll: Reverse, from front of roller.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Translucent.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Exposed with endcaps.
b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Shade Pocket: For mounting as indicated on the drawings.

1. Extruded aluminum shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
2. Basis of Design: 4133 surface mounted with endcaps, as per details.

G. Installation Accessories:

1. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
2. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 MANUALLY OPERATED SHADES WITH DOUBLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
2. Inside Roller:

a. Drive-End Location: As indicated on Drawings.
b. Direction of Shadeband Roll: Regular, from back of roller.

3. Outside Roller:

a. Drive-End Location: As indicated on Drawings.
b. Direction of Shadeband Roll: Regular, from back of roller.

4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Inside Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Outside Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

G. Shade Pocket: For mounting as indicated on the drawings.

1. Extruded aluminum shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
2. Basis of Design: 4133 surface mounted with endcaps, as per details.
3. Retain "Recessed Shade Pocket" Subparagraph below for roller enclosure installed above the ceiling.

H. Installation Accessories:

1. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
2. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets shall not be acceptable.

1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
   a. Hembar shall be heat sealed on all sides.
   b. Open ends shall not be accepted.
2. Shade band and Shade Roller Attachment:
   a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
   b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" Spline mounting, without having to remove shade roller from shade brackets.
   c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
   d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

C. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: PVC-coated polyester.
3. Weave: Dense Vertical Weave.
4. Roll Width: 96 inches (244 mm).
5. Orientation on Shadeband: Up the bolt.
6. Openness Factor: 3 percent.
7. Color: As selected by Architect from manufacturer's full range.

D. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: Acrylic-coated fiberglass.
3. Roll Width: 98 inches (249 mm).
4. Orientation on Shadeband: Up the bolt.
5. Features: Flame retardant and flame resistant.
6. Color: As selected by Architect from manufacturer's full range.

2.5 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4 provide battens and seams at uniform spacing along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.
3. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
    a. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
    b. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches (38.1 mm) high and be totally opaque. A see-through moire effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.6 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 12 24 13

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1.00 MANUFACTURERS

A. The basis of this specification is wood casework manufactured and constructed according to the standards used by Leonard Peterson & Co., Inc., 400 Webster Road, Auburn, Alabama. The specified design is **Vanguard – CONVENTIONAL RADIUS LIP.** All laboratory equipment covered by the specification shall be the product of one manufacturer and be fabricated at one geographic location to assure shipping continuity and single-source responsibility. All quotations from a manufacturer other than Leonard Peterson & Co., Inc. shall contain a review of the following capabilities:

1. List of shop facilities
2. List of engineering and manufacturing personnel
3. Proof of financial ability to fulfill the contract
4. List of a minimum of ten (10) installations over the last five (5) years of comparable scope
5. Proof of project management and installation capabilities
6. AWI Premium Grade Certification Number.

B. The selected manufacturer must warrant for a period of three (3) years, starting on the date of acceptance or occupancy, whichever comes first, that all products sold under the contract referenced above shall be free from defects in material and workmanship. Purchaser shall notify the manufacturer's representative immediately of any defective product. The manufacturer shall have a reasonable opportunity to inspect the goods. The purchaser shall return no product until receipt by purchaser of written shipping instructions from the manufacturer.

C. Samples:
Samples from non-specified manufacturers will be required and reviewed per specification. Samples shall be delivered, at no cost to the architect or owner to a destination set forth by the architect or owner. This must be done seven (7) days before quotation deadline as a condition of approval of each bidder. Samples shall be full size, production type samples. Miniature, or "Show Room" type samples are not acceptable. Furnish the following:

1. One combination drawer and cupboard base unit showing complete construction details, including one shelf.
2. One leg corner sample showing table construction.
3. One sample of all top materials shown or called for, of sufficient size to perform finish requirements test.
4. Sample of mechanical service fittings, locks, door pulls, hinges, and interior hardware and other material deemed necessary for review.

D. The above samples of the successful manufacturer may be impounded by the architect or owner to insure that material delivered to the jobsite conforms in every respect to the samples submitted.

2.00 MATERIALS

A. General:

1. Casework shall be conventional radius lipped design and constructed in accordance with the best woodworking practices. All cabinetry shall be produced in manufacturers own facility and operated under his control and supervision.

First class quality of casework shall be established and maintained by use of proper machinery, finishing products, tools, fixtures and skilled workmanship.

2. Casework units to be dowel pin construction with all joints properly glued making each unit rigid and self-supporting.

3. Material shall be selected so that the finished installation shall provide an attractive and harmonious appearance. All exterior casework surfaces exposed to view after installation shall be Maple. Solid woods and veneers behind closed doors or drawers shall be of color and graining in conformance with the normally accepted standard required of the scientific laboratory equipment industry.

B. Solid Woods:

All solid woods shall be hardwood carefully and thoroughly air-dried, then kiln dried in humidity controlled kilns to a moisture content of 4-1/2%. All kiln dried lumber shall then be tempered to a moisture content of 6% before use. This moisture content shall be maintained throughout production.

C. Plywoods:

All plywood shall be hardwood plywood. Soft woods such as Fir or Pine are not permitted.

1. Veneer Core Plywood:

Veneer core plywood shall be either 7-ply (3/4") or 9-ply (1") and shall be compliant with ANSI/HPVA HP-1 2009.

2. Composition Core Plywood:

Composition core plywood shall be 3-ply and shall be compliant with ANSI A208.1-2009, and/or ANSI A208.2-2009.

3. Face Veneers:

Plywood face veneers shall be Grade A, plain sliced, book matched, Red Oak on face, and Grade 1, Red Oak on back.

D. Banding:

Plywood panels to shall be edge banded as specified with a multiple ply hardwood edge-banding or 1/8" (3mm) solid lumber to match exposed cabinet veneer.

E. Tempered Hardboard:

Tempered Hardboard shall be a wood fiber/resinous combination formed with heat and pressure into sheets providing a hard, smooth surface and shall be compliant with ANSI A135.4-2004.

F. Dowels:

Assembly dowels, used to joint rails to panels, shall be fluted hardwood 8mm in diameter x 36mm in length. All dowels glued into components.

G. Glass:

Glass for framed sliding and swinging doors shall be 1/8" float glass (tempered glass provided when specified). Glass for unframed sliding doors shall be ¼" float glass.

H. Glues:

All glues used in the manufacture of plywood, assembly of component parts and cabinetry to be water resistant with no added urea formaldehyde.

I. Finishes:

Conversion varnish with no added urea formaldehyde and shall comply with HUD 24 CFR 3280.308.

Custom Wood Maple Finish as selected by Architect will be required on all Base Cabinets.

Custom White Finish as selected by Architect will be required on all Wall Cases

J. Hardware:

1. Drawer and door pulls: Bar Type made of extruded aluminum 4-1/2" long and ½" wide having dull brushed finish. Pull attached with two (2) No. 10 flat head machine screws countersunk on 4"centers. Pulls provided for all hinged doors and drawers. (Plastic pulls or a design not compatible for use by the handicapped is not acceptable.) **Pulls to be Black**

2. Latching Handles: Made of dull chrome plated die cast zinc alloy approximately 4-1/4" in length in streamlined design. Handle operates with one-quarter turn. Paired door cases have latching handle on right door and dummy matching handle on left door. A 3-point latching system provides positive engagement at top and bottom of door with 5/16" diameter tapered epoxy coated steel rods engaging in case top and bottom and latch plate engaging behind left door or into side wall of case depending upon design. Latching handles are provided on all case doors over 48" high.

3. Hinges: Butt style, 5-knuckle, institutional type of dull finished stainless steel, 2-1/2" by 3-1/8", unequal winged, tight pinned and with wing thickness of .081". Each hinge is secured by seven plated No. 7 flat head screws. (Surface mounted hinges shall not be acceptable.) **Hinges to be Black**.

   Doors hung with paired hinges are capable of supporting 175 pounds at 12" from pivot point of hinges with no distortion of hinges or degradation of casework. Hinged doors up to 48" high furnished with 1 pair of hinges. Hinged doors over 48" high furnished with 1-1/2 pair of hinges.

4. Drawer Slides: 100 lb. rated capacity, full extension, zinc plated, linear ball bearing made of cold rolled steel. Drawers removable without the use of tools.

5. Shelf support clips: double pin type made of vinyl having anti-tipping seismic feature. Each clip capable of supporting 200 pounds. Clips engage into holes drilled into cabinet end panels or partitions.

6. Catches: spring loaded, nylon roller type, designed for quiet operation provided for hinged doors. Cabinets with locked paired doors have elbow catches inside left-hand doors. Cabinet and case doors provided with 2 catches, one at top and one at bottom, where elbow catches are not furnished.

7. Base molding (when call for or specified): pliable black vinyl, 1/8” thick by 4” high with top edge rounded. Molding secured with self-stick or applied waterproof adhesives. Formed stainless steel caps are fastened to exposed corners. Exposed cabinet work provided with base molding unless otherwise specified.

8. Leg shoes: molded black vinyl 2-1/2” high. Legs attached to floor provided with shoes, and furnished with semi-concealed plated metal angle clips for securement.

9. Drawer and hinged door locks (except tall case doors): dead bolt style, heavy-duty, five-tumbler, of non-ferrous metal and master-keyed having 3/8” bolt throw and single bitted style keyway. Barrel and back plate of locks are riveted together; lock bolts are non-removal. Locks with cams held in place with machine screws or nuts are not acceptable. Locks are secured to rear of drawer and door fronts with flat head screws. Each lock furnished with one non-ferrous key when keyed alike and two non-ferrous keys when keyed differently. Locks furnished as indicated on details or as is standard with catalog descriptions unless otherwise specified. Latching handles shall be provided with locks where required. Locks shall be keyed to same master key as locks provided for other drawer and hinged door cabinets. **Locks to be Black and furnished on all doors and drawers**.

10. Number plates: oval-shaped and made of non-ferrous metal with black numerals. Plates secured with brads (self-stick number plates are not acceptable). Number plates furnished only when specified.

11. Glides: black nylon, minimum 1-3/4” diameter and adjustable on 3/8” diameter x 1-1/2” plated stem. Glides provide on table legs not attached to floors.

12. Support rods, ¾” diameter aluminum with the upper ends rounded and the lower ends tapered to fit support rod plates. Support rod plates made of aluminum secured into table top with heavy brass nut. Cross bars made of ¾” diameter aluminum with rounded ends, and provide with clamps for attachment to support rods.

13. Label holders: Furnished in brushed stainless steel attached to drawer heads or doors with screws. Label holders have a 1” x 2” label opening.

2.01 CONSTRUTION

A. General:

The prime intent of this specification is to define the essential minimum cabinet case and table requirements of the materials, and construction, finish and workmanship to be supplied. Cabinetry to be of convention lipped style design having drawer and doors provided with radiused edges overlapping openings on all edges. Each cabinet unit shall be completely factory assembled and finished. Cabinets constructed with flush interiors having no offsets maximizing drawer and cupboard space and ease of cleanability. All

exposed joints shall be closely fitted and tight showing no open joints when finished. All exposed corners eased. Individual cabinet, case and table units shall meet or exceed the Recommended Standards and Practices outlined in SEFA 8.

B. Base Cabinets:

1. End panels, partitions, bottoms and shelves:

Exposed end panels, partitions, bottoms and shelves to be ¾" thick red oak veneer core plywood. Unexposed end panels, partitions, bottoms and shelves to be ¾" thick Red Oak veneer core plywood. Unexposed end panels, partitions, bottoms and shelves to be ¾" thick birch or maple veneer core plywood providing light cabinet interiors behind closed doors. Exposed edges of components to be banded in red oak.

Interiors of end panels and partitions to be drilled to receive dowel inserted edges of rails, bottoms and toe boards and bored for shelf clips where required. Bottoms machined for and provided with dowels (on maximum of 96mm centers) for insertion into end panels or partitions and grooved to receive cupboard backs.

Cupboard base cabinet shelves to be ¾" thick veneer core plywood, provided full depth and adjustable on 1-1/4" (32mm) centers.

2. Top Frame:

Cabinet top frame to be comprised of a front rail and a back rail. Front rail to be 4" x 1" hardwood having exposed edge red oak banded and end edges drilled and provided with three (3) dowels for horizontal glued insertion into cabinet end panels at front. Back rail shall be ¾" hardwood varying in height from 9" high for 35" high cabinets to 7-3/4" high for 29" high cabinets and inserted vertically at rear into cabinet end panels. End edges of back rails each drilled and provided with four (4) dowels for glued insertion into ends panels.

3. Intermediate Rails:

Intermediate Rails to be 4" x ¾" hardwood having exposed edge red oak banded and end edges each drilled and provided with 3 dowels for insertion into end panels. Intermediate rails placed horizontally at face of panels between all drawers or drawers and cupboards. Intermediate rails machined to receive engagement of lock bolts and security panels when specified.

4. Backs:

Interior cupboard backs to be ¼" thick tempered hardboard and provided removable. Backs set into grooved cabinet bottom and attached at top to rear vertical rail with minimum of two (2) screws. Exposed interior cupboard backs to be ¼" veneer core red oak plywood provided removable unless specified as fixed.

Exposed exterior finished oak backs for free standing cabinets or mobile units to be of ¾" thick red oak veneer core plywood with exposed edges banded. Free standing units up to 8'0" long shall be provided with one piece back and shipped assembled to cabinets.

5. Drawers:

Drawer fronts to be 13/16" thick one piece solid oak up to 8" high with grain running horizontally. Drawer sides and backs to be 15/32" thick, 11 ply birch plywood and bottoms ¼" tempered hardboard. Drawer front and back attached to sides with interlocking lap or dovetail joinery. Bottom fully grooved into front, sides and back. All joints glued and pinned as required.

Drawers provided with 100 lb. full extension slides and pulls as described under Hardware. Drawers over 26" wide to have two (2) pulls.

Base Cabinet Drawers to be furnished with Plastic Laminate Fronts with color as selected by the Architect.

6. Security Panels:

Security panels shall be ¼" thick tempered hardboard attached to back of front intermediate rails and fastened into security clips or rails at rear of cabinet. Security panels provided only when locks are keyed differently between drawers or drawers and cupboards.

7. Hinged Paneled Doors:

Doors shall be 13/16" thick of 5-ply construction having solid core with hardwood framing minimum 1-3/4" wide, hardwood crossbands and vertical veneered oak faces. Paired cabinet doors to have matched grain pattern. Doors provided with two (2) hinges, one (1) pull and one (1) catch as described under Hardware.

Base Cabinet Drawers to be furnished with Plastic Laminate Fronts with color as selected by the Architect.

8. Toe Spaces:

Base Cabinets to have recessed toe space 4" high x 2-1/2" deep. Toe board made of ¾" thick water resistant hardwood. End edges machined for and provided with three (3) dowels for glued insertion into cabinet end panels. Toe boards further secured to underside of bottom with glue block(s) for rigidity.

C. Wall Cases, Counter Mounted Cases, and Tall Storage Cases:

1. End Panels, Partitions, Bottoms and Shelves:

Exposed end panels, partitions bottoms and shelves to be Red Oak Veneer core plywood. Unexposed components to be birch or maple veneer core plywood. All exposed front edges to be edge banded. End panels machined to receive doweled bottoms, tops and toe boards. Dowels to be spaced on maximum 96mm centers. End panels bored to receive adjustable shelf clips on 1-1/4" (36 mm) centers.

End panels, partitions and bottoms of tall cases to be ¾" thick.

Tops, of wall cases, counter mounted cases and tall cases to be 1" thick. Bottoms of wall cases and counter mounted cases to be 1" thick. All exposed front edges to be hardwood edge banded.

Wall and counter mounted cases to be provided with ¾" thick veneer core plywood shelves. Shelves for tall case to be 1" thick veneer core plywood. Exposed front edge of shelves to be red oak banded. All shelves to be full depth and adjustable except for center shelf provided in tall cases which shall be fixed.

2. Backs:

Unexposed interior backs shall be ¼" tempered hardboard grooved into tops, ends and bottoms. Exposed interior backs shall be ¼" veneer core red oak plywood attached to tops, ends and bottoms. Backs are further supplied and secured with ¾" x 4" wide batten strips behind back of backs for reinforcement and through which hardware shall be attached for securement to walls. Exposed exterior back shall be ¾" thick veneer core red oak plywood having red oak edge bands.

3. Toe Boards:

4" high toe boards provided at base of tall storage cases shall be ¾" thick water resistant hardwood. End edges to each machined for and provided with 3 dowels for insertion into case ends. Toe boards set flush with face of ends and further secured to underside of bottom with glue block(s) for rigidity.

4. Hinged Panel Doors:

Doors up to 48" high shall be 13/16" thick. Doors over 48" high shall be a minimum 1" thick. Door shall be of 5-ply construction same as described for base cabinets and provided with similar hardware except doors over 36" high to have 1-1/2 pair of hinges and 2 catches.

Tall case doors to be provided with latching handles securing doors to cabinet walls or behind left hand doors and to case tops and bottoms.

5. Hinged Glassed Doors:

Doors up to 48" high shall be 13/16" thick and over 48" high shall be a minimum 1" thick. Door shall be made of 2-1/2" wide solid maple (plywood not acceptable) rails having mitered mortis and tenon corner glued and reinforced with dowels.

Doors provide with hardware same as described for panel doors.

Wall Case Doors to be furnished with White Markerboard Surface.

D. Apron and Table Frame Construction:

1. Apron and table frames made of solid hardwood lumber. Exposed rails minimum ¾" thick x 4-3/4" high red oak grooved for acceptance of cross rails and corner blocks.

2. Reinforcing cross rails made of solid hardwood, grooved, glued and screwed into front and back rails.

3. Apron and table rail corner blocks, for attachment of legs shall be 13 gauge formed plated steel grooved and screwed into aprons.

4. **Student Table Legs to be 2" square 14 gauge black power coated steel telescoping for height adjustment. Legs attach to apron corners with a 3/8" diameter chrome plated bolt having head conforming to leg edge rounding, passing diagonally through leg. Legs furnished with 3" diameter casters**

5. Panel legs, for attachment of aprons, to be 1-1/4" thick constructed of hardwood plywood having top and bottom concealed solid hardwood bands. Exposed edges faced with solid oak bands.

E. Cabinet Finish:

1. After assembly of cabinets but prior to the application of wood stain and sealing cabinet and case parts to be sanded smooth and loose fibers and dust removed.

2. Exposed cabinet and case parts and backs of doors then receive an application of stain. Excess stain to be removed by wiping with wood wool and/or cloth, and parts allowed to thoroughly dry. Unexposed interiors behind solid doors and drawers left natural providing light interiors for ease of viewing.

3. After drying, exposed parts, cabinet and case interiors, shelves, drawers and doors to receive a double coat of clear resinous wood sealer. Exposed cabinet parts, drawers, doors, and cupboard and case interiors then receive a double coat of clear, chemical resistant synthetic varnish. Between all applications of sealer and varnish, cabinet parts to be lightly sanded and wiped. The resulting exterior finish shall be semi-gloss and provide an acid, alkali, solvent, water and abrasive-resistant surface.

4. Applied finish to meet Finish Test Requirements of SEFA 8.

5. Custom Maple Finish as selected by Architect will be required on all Base Cabinets.

6. **Custom White Finish as selected by Architect will be required on all Wall Cases**.

2.02 COUNTERTOPS:

1. General:

A. Countertops constructed per specification covering particular type.
B. Tops having sinks provided with drip grooves cut into underside of exposed edges.
C. Adhesives or fasteners to be provided for securing of tops to cabinet work. Such materials to allow for contraction or expansion of tops where necessary.
D. Tops shall be 1" thick unless otherwise specified and provided with 4" high curbs where tops abut walls, columns, case ends, etc.

2. Types:

A. **Phenolic Resin** is fabricated from composite panels comprised of multiple layers of selected papers impregnated with special phenolic resins, manufactured under heat and pressure to form a solid black chemical resistant composite throughout the entire thickness of the panel. Tops shall be furnished black in color having black exposed edges honed smooth and exposed corners and edges chamfered back approximately 1/8". Tops shall have a non-glaring surface.

2.03 SINKS:

1. Epoxy resin sinks are cast of black modified epoxy resin having high resistance to chemicals, heat and shock as normally encountered in laboratories. Castings are done in permanent molds producing sinks with all inside corners coved and bottoms dished. Sinks to be drop-in style.
   Epoxy resin sinks provided with 1-1/2" epoxy resin outlets.
   Tail pieces, traps and drain lines to be furnished by Others unless otherwise noted on details or in equipment schedule.

2. Sinks shall be installed by Casework Contractor.
   Outlets to be installed by Others.

2.04 PLUMBING FIXTURES:

1. Plumbing and Gas fixtures to be **Water Saver ColorTech Black Powder Coated.** Water fixtures to be **Lead Free**.
   Fixtures provided with brass tank nipples complete with locknuts and washers for attachment to countertops.
   Water fixtures provided with inline vacuum breakers unless otherwise indicated.
   Fixtures supplied assembled (tank nipples loose).

2. Safety shower and eyewash units shall be furnished in make and model numbers listed on the drawings or outlined in equipment schedule as manufactured by Water Saver Faucet Co.

3. Pedestal electric boxes, cast aluminum finished in black textured coating furnished with tank nipples and locknuts for attachment to countertops.
   Electrical boxes mounted in table or cabinet aprons shall be steel.
   Electric receptacles, switches, etc., shall be specification grade 20 amp and UL approved. Receptacles located within 6'0" of sinks to be G.F.I. type.
   Cover plates for receptacles shall be stainless steel.
   Mounting of electric boxes in table aprons or cabinet units to be by Casework Manufacturer.

3.00 EXECUTION

1. For approval by owner or architect, within 30 days after receipt of order submit shop details showing floor plans, rough-ins and elevations of casework and equipment being supplied. Floor plans with rough-in details to be in 3/16" scale. Elevation drawings to be in 3/8" scale.

2. Prior to fabrication of casework field check project site to assure proper fit of materials being provided. Adjust drawings as necessary to insure proper fit of all casework and equipment to building conditions.

3. Deliver casework only after wet operations are complete and building is closed in, dry and has proper climate control for installation of casework.
   (Area in which laboratory casework is installed to be maintained between 65 and 75 degrees F. with relative humidity maintained between 45% - 55%.)
   If these conditions are not met and maintained, product warranty is void.

4. Install casework in accordance to manufacturers recommended practice by qualified casework installer having a minimum of 3 years' experience in the installation of institutional casework.

5. Adjust casework and hardware so that doors and drawers operate smoothly. Lubricate operating hardware as recommended by manufacturer.

6. Advise owner or contractor on procedures and precautions to be taken to protect casework and other materials installed from damage by work performed by other trades.

7. During installation keep job site clean and remove debris on a daily basis. Floors are to be broom cleaned upon completion.

SECTION 12 36 61 - SIMULATED STONE COUNTERTOPS

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 performance criteria, materials, production, and erection of simulated stone countertops for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all simulated stone countertops as required by the this section, schedules, keynotes and drawings, including, but not limited to the following:

1. Solid-surface-material countertops, backsplashes with under mount stainless steel where indicated.
2. Quartz agglomerate countertops and backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.
2. One full-size solid-surface-material countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.
3. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. Endsplash: Matching backsplash.

B. Countertops: 3/4-inch- (19-mm-) thick, solid surface material

C. Backsplashes: 3/4-inch- (19-mm-) thick, solid surface material.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Install integral sink bowls in countertops

2.2 COUNTERTOP MATERIALS

A. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Particleboard: ANSI A208.1, Grade M2, made with binder containing no urea formaldehyde.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

D. Adhesives: Adhesives shall not contain urea formaldehyde.

E. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Caeserstone– Basis of Design- Quartz
   b. Dupont
   c. Corian.
   d. Formica Corporation.
   e. Wilsonart International.

2. Type: Provide Standard Type unless Special Purpose Type is indicated.
3. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
4. Colors and Patterns: As indicated by manufacturer's designation and selected by Architect.

2.3 FACTORY FABRICATION

A. Shop assembly
1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
2. Form joints between components using manufacturer's standard joint adhesive joints.
a. Reinforce as required.
3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
4. Rout and finish component edges with clean, sharp returns.
a. Rout cutouts, radii and contours to template.
b. Smooth edges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

C. Keep components and hands clean during installation.
1. Remove adhesives, sealants and other stains.
2. Components shall be clean on date of substantial completion

3.2 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 12 36 61

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SECTION 12 48 13 – ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the performance criteria, materials, production, and installation of entrance floor mats, including fibered roll goods, for the project. The work performed under this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all entrance floor mats as required by the this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Submit selection and verification samples of the floor mats.

C. Product Schedule: Use same designations indicated on Drawings.

1.4 INFORMATION SUBMITTALS

A. Test and Evaluation Reports

1. Product test reports: As required by Conditions of the Contract and Division 1 Regulatory Requirements Section, submit test certificates from an independent test laboratory showing compliance with specified performance characteristics and physical properties.

2. Compatibility and adhesion test reports: Submit test reports confirming adhesive's effectiveness with the product(s) specified.

3. Manufacturer Instructions: For specified products, submit latest editions of product supplier's installation and cleaning & maintenance instructions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor mat to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer: Installer shall be highly experienced in performing work of this section, having previous done fiber roll goods installation work similar to that required for this project.

B. Testing Agency: Agency(ies) shall be independent and qualified to perform the specified product tests.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirements Section

B. Delivery and Acceptance Requirements: Comply with the product supplier's ordering and lead time requirements to avoid construction delays, and to allow material to acclimatize as required in the specified product's installation instructions. Accept delivery of materials only if they are in unopened, undamaged packaging that bears the name and brand of the manufacturer/product supplier, project identification, and shipping and handling instructions.

C. Storage and Handling Requirements: Store material -- including any adhesive and accessories -- in the original packaging (as delivered) in areas that are enclosed and weather tight with the permanent HVAC system set at a temperature of between 65°F and 80°F for a minimum of 48 hours prior to commencement of installation. In addition, comply with storage and handling requirements listed on product packaging, and described in the latest edition of the product's installation instructions

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (21 deg C) or more than 80 deg F (35 deg C) during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 HEAVY TRAFFIC CARPET MATTING

A. Basis of Design: Subject to compliance with requirements, provide the product indicated on drawings or comparable product to the following:
1. 3M "Nomad 8850 Carpet Matting" By Mats, Inc., Stoughton, Ma.: Construction:

a. Large diameter polypropylene, small diameter nylon with Flexion vinyl backing.

Width: Recessed in flooring. Refer to finish plans.
Length: Recessed in flooring. Refer to finish plans.

Sizes: Custom – Refer to finish plans.
Thickness: 5/16”
Weight: 103.23 ounces/square yard

b. Performance: Physical properties of the entrance matting shall conform to the following minimums:

Safety	
Surface flammability	ASTM D2859: Pass (equal to CPSC FF 1-70)
Performance	
Electrostatic propensity	AATCC 134: Step: -1.88 kV; Scuff: -1.38 kV

B. Colors: As selected by Architect.

2.2 ACCESSORY PRODUCTS

A. Matting tape and adhesives as supplied by floor mat manufacturer for complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installation.

B. Interface with Other Work: If transitions are required to and/or from the specified entrance matting, contact Mats Inc. for suitable transition material.

C. Sizes: 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 possible, verify sizes by field measurement before shop fabrication.

D. Accessory selection: Where indicated for recessed or wall-to-wall applications provide aluminum framework as recommended by manufacturer. Where indicated for surface-mounted applications, provide tapered vinyl moldings with flanges sewn to back of mat on all four sides with mitered corners.

3.3 CLEANING AND PROTECTION

A. General: Clean up job site, including sweeping or dust mopping the floor to remove all dirt or grit, and put all waste in general contractor's dumpster. Follow overall cleaning guidelines described in Division 01.

B. Maintenance: Conduct a full initial maintenance following the latest edition of the manufacturer's maintenance instructions. Instruct owner's cleaning staff in proper maintenance procedures.

3.4 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 12 48 13

SECTION 13 34 16 – FIXED BLEACHER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Telescopic Gym Seating includes **manually operated/fixed** multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purpose, as shown on the drawings.

B. Related Sections include the following:
   1. Division 05 Metals
   2. Division 09 Finishes
   3. Division 26 Electrical sections for electrical wiring and connections for electrically operated telescoping stands.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each telescoping stand unit according to ICC 300 2023.

B. Manufacturer's System Design Criteria:
   1. Gymnasium seat assembly; Design to support and resist, in addition to its own weight, the following forces:
      a.) Live load of 120 lbs. per linear foot (1.75 kN/m) on seats and decking
      b.) Uniformly distributed live load of not less than 100 psf (4.79 kN/m^2) of gross horizontal projection.
      c.) Parallel sway load of 24 lbs. per linear foot (0.35 kN/m) of row combined with (b.) above
      d.) Perpendicular sway load of 10 lbs. per linear foot (0.15 kN/m) of row combined with uniformly distributed live load above.
      e.) Parallel and Perpendicular sway loads are not applied concurrently.
   2. Hand railings, Posts and Supports: Engineered to withstand the following forces applied separately:
      a.) Concentrated load of 200 lbs. (0.89 kN) applied at any point and in any direction.
      b.) Uniform load of 50 lbs. per foot (0.73 kN/m) applied in any direction.
   3. Guard Railings Post and Supports: Engineered to withstand the following forces applied separately:
      a.) Concentrated load of 200 lbs. (0.89 kN) applied at any point and in any direction along top rail.
      b.) Uniform load of 50 lbs. per foot (0.73 kN/m) applied in any direction at top rail

c.) Uniform load of 50 lbs. (0.22 kN) applied on an area equal to 1 ft^2 (0.09 m^2) applied on all guardrail infill panels.

1.4 SUBMITTALS

A. Product Data: Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

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

C. Samples for Selection.

1.5 PROJECT CONDITIONS

A. Field Measurements: Coordinate actual dimensions of construction affecting telescoping stands installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

1.6 MATERIALS

A. Wood:
1. Lumber: NIST PS 20, southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B&B Finish (B and better) grade-of-finish requirements.
2. Plywood: NIST PS 1, APA-grade trademarked, A-C grade.

B. Steel:
1. Structural-Steel Shapes Plates, and Bars: ASTM A36.
a.) Galvanized-Steel Sheet: ASTM A653, Grade 40 (276 MPa) coating designation G60.
b.) Uncoated Steel Strip; Non-Structural Components: ASTM A1011, Commercial Quality, Type B, Hot-Rolled Strip.
c.) Uncoated Steel Strip; Structural Components: ASTM A1011 Grade 33 (228 MPa), Grade 36 (249 MPa), Grade 40 (276 MPa), Grade 45 (311 MPa), or Grade 50 (345 MPa), Structural Quality, Hot-Rolled.
d.) Galvanized Steel Strip: ASTM A653 Grade 40 (276 MPa) or Grade 64 (441 MPa), structural quality, coating designation G60.
e.) Tubing: ASTM A500, cold formed; Grade B, or ASTM A513, 46 ksi min yield.

C. Polyethylene Plastic: High-density polyethylene; injection molded, color-pigmented, textured, impact-resistant, and dimensionally stable.

1.7 MANUFACTURERS

A. Manufacturer: Basis of Design – Subject to compliance with requirements, provide products from the following: Hussey Seating Company, USA., North Berwick, Maine 03906. Product: **MAXAM Telescopic Gym Seat System.**

1.8 TELESCOPING STANDS

A. Wall-Attached Telescoping Stands: Forward-folding system with the rear of the understructure permanently attached to the floor and to the rear wall. Rear wall provides structural support and must support loads imposed by the bleacher.

B. Floor-Attached, Freestanding Telescoping Stands: Forward-folding system with the rear of the understructure permanently attached to the floor only.

1.9 DIMENSIONAL AND OPERATIONAL CRITERIA

A. Dimensions:
1. Bank Length: Selected by Architect.
2. Aisle Width: Not Included.
3. Number of Tiers: Selected by Architect.
4. Row Rise: Selected by Architect.
5. Open Dimension: Selected by Architect.
6. Closed Dimension: Selected by Architect.
7. Overall Unit Height: Selected by Architect.
8. Net Capacity: Selected by Architect
9. Maximum Net Capacity; with Flex Row Fully Recovered: Selected by Architect.

B. Operation: Manual – User operates system by manually pulling/pushing each section with operating handles

1.10 SEATING

A. Polymer Seat System: Courtside Collection
1. Material: Gas assist injection-molded, 100 percent recyclable HDPE, high density polyethylene.
a.) Module Size: 18 inches (457 mm) long by 12 inches (305 mm) deep.
b.) Module Load: Tested to 600 lbs. (2.67 kN).
c.) Seat height range from deck to top of seat: Selected by Architect.
d.) Integrally molded end caps at aisle end locations.
e.) Integrally molded recess pockets to accept seat number and row letters.
f.) Integrally molded rear closure panel at back of seat to allow for "continuous clean sweep" of debris at deck level and minimized visibility of structural ribbing.
g.) Color: Selected by Architect.
h.) Courtside XT Seat Spacer – Optional
i.) Spacer size: 4.5 inches (114mm)
j.) Material: Gas assist injection-molded, 100 percent recyclable HDPE, high density polyethylene
k.) Color: To be Selected by Architect. Submit color sample of 301 Blue and 289 Dark Blue

B. ADA Accessible Seating

a.) Locate **first tier modular units** to provide wheelchair-accessible seating at locations indicated on Drawings.
b.) Flex-Flow™: Provide first row modular recoverable seating units that can be closed to accommodate persons requiring ADA spaces (or any other temporary space needs) or

opened for standard usage. Each Flex-Row unit shall have a handle for easy operation.

1) Provide a black full-surround steel skirting with no more than ¾" floor clearance for safety and improved aesthetics.
2) Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.
3) Provide a mechanical positive lock when the Flex-Row system is in both the open and closed position. Handle shall unlock the modular recoverable seating unit for operation.
4) Flex-Row can be utilized with the full system in the open or closed position.
5) Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 to 7 seats wide as well as full section widths.
6) Flex-Row Removable belt barrier.
7) Available signage to mark location of each recoverable Flex-Row module to assist with seating identification. Size of Signage to be provided by Architect.

1.11 COMPONENTS

A. Decking
   1. Plywood
      a. 5/8 inch (16 mm) thick AC grade tongue and groove Southern Yellow Pine with clear urethane, high gloss finish.
   2. Polydeck
      a. 5/8 inch (16 mm) thick BC grade polyethylene-top-coated tongue and groove Douglas Fir plywood.
      b. Polyethylene overlay bonded to substrate **0.03 inch (0.8 mm)** thickness.
      c. Color: Selected by Architect.
   3. Carpet
      a. Provide at decks and steps tufted, level loop, TARR rated – 'heavy foot traffic' - polyester pile with woven synthetic backing. Mount to plywood deck as substrate. Carpet color to be of manufacturer's standard selection.
   4. As selected by Architect from Manufacturers standard colors.

B. Understructure:
   1. Finish: Selected by Architect.
   2. Hardware Finish: Selected by Architect.
   3. Posi-locks and other surfaces: Selected by Architect
   4. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40 (276 MPa). Riser beam shall be continuously roll-formed of ASTM A653 Grade 64 (441 MPa). Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly. Nose beam and riser beams are through-bolted fore/aft to deck stabilizers and frame cantilevers to create the deck structure.
   5. Frame: The frames are welded assemblies (one left hand, one right hand per tier) comprised of the following components:
      a. Lower Track subassembly: ASTM A1011 Grade 50: Continuous Positive Interglide System (casterhorn) interlocks each adjacent frame casterhorn using an integral, continuous, anti-drift feature and captive interlock with adjustable row spacing at front to prevent separation and misalignment.

b. Lower Track Wheels: 3 per frame Not less than **5 inches (127 mm)** diameter by **1-1/4 inches (32 mm)** with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit **3/8 inch (10 mm)** diameter axles secured with E-type snap rings.
   1) Option: up to 6 wheels per frame for load distribution

6. Slant Columns: A500 Grade B, tubular sharpe.
7. Cantilever Subassembly: Consists of ASTM A1011 Grade 50 nose connection plate, cantilever, and riser attachment plate welded together into a subassembly.
8. Lock System: Casterhorns at the end sections of powered banks (minimally), and manual sections, contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
9. Sway Bracing: ASTM A653 grade 40 (276 MPa), tension members bolted to columns.
10. Deck Stabilizer: A1011 Grade 45, member through-bolted to nose and riser at three locations per section. Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment.

C. Fasteners: Vibration proof, in manufacturer's standard size and material.

1.12 TRANSPORT SYSTEMS

A. Integral Mechanical Dolly: Provide one pair of machine-screw-jack dollies; per section, for transport of movable telescopic sections. Each dolly shall be fitted with **6 inch (152 mm)**, 360 degree swiveling kingpinless casters to insure ease of telescopic section movement. Wheel treads shall be molded polyurethane bonded to cast iron hubs with roller bearings. Dollies are integral to each section and shall be operated by a cordless drill through access holes in either the front or rear of the section. Dollies shall be designed to engage front and rear structural steel lift beams.

B. Portable Hydraulic Dolly: Provide one pair of portable hydraulic dollies; per section, suitable for transport of movable telescopic sections. Each dolly shall be fitted with sufficient quantity of **5 inch (127 mm)**, 360 degree swiveling kingpinless casters to insure ease of movement. Wheel treads shall be molded polyurethane bonded to cast aluminum hubs with roller bearings. Dollies shall be inserted manually beneath the front of first telescoping row with seating completely closed. Dollies shall be designed to engage front lift plates and rear structural steel lift beams.

1.13 FABRICATIONS

A. Fabricate understructure from structural-steel members in size, spacing, and form required to support design loads specified in referenced safety standard.

B. Weld understructure to comply with applicable AWS standards.

C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.

1.14 ACCESSORIES

A. Operating Handles: Manual operating handles; **3/4 inch (19 mm)** OD steel tubing. Handles to engage at the first tier.

B. Rear Deck Filler: Provide at rear deck level an extended rear deck filler. Available for wall attached and free standing applications.

C. Deck Lock

D. Access Panels (Hatchways): Provides maintenance access to the understructure, for wall to wall applications, at the fourth or fifth tier.

1.15 GRAPHICS

A. Custom Signature Logo - Factory or Dealer-designed logo with CourtSide Seats that incorporates school letters or graphical representation of school logo across the front of the bleachers.

1. Logo is visible when the bleachers are in the stored position.
2. Select up to three seat colors for maximum color contrast and creativity.

PART 2 - EXECUTION

2.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level.

B. Tolerances:
1. Flooring and rear wall: Level and plumb within **1/8 inch (3 mm)** in **8 feet (2438mm).**
2. Maximum bleacher force on the floor of a **27 foot (8230 mm)** section: Static point load of less than 300 psi (2068 kN/m^2).

C. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

2.2 ADJUSTING AND CLEANING

A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.

B. Clean installed telescoping stands on exposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

2.3 WASTE MANAGEMENT

A. Coordinate with Section 01 74 23.

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other scrap for recycling.

END OF SECTION 13 03 20

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SECTION 13 47 17 - BULLET RESISTANT STOREFRONT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bullet Resistant Storefront System.

B. Bullet Resistant Fixed Sash.

C. Bullet Resistant Doors.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.

B. Section 06 10 00 - Rough Carpentry.

C. Section 08 71 00 - Door Hardware.

1.3 REFERENCES

A. ASTM International (ASTM):
1. ASTM A 36 / A36 M - Standard Specification for Carbon Structural Steel.
2. ASTM A 924 / A 924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
3. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM C 509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
6. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
7. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
8. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass.
9. ASTM D 2000 - Standard Classification System for Rubber Products in Automotive Applications.
10. ASTM E 1986 - Standard Test method for performance of exterior windows, curtain walls, doors and storm shutters impacted by missiles and exposed to cyclic pressure differentials.

B. Aluminum Association Standard AA DAF-45 - Designation System for Aluminum Finishes.

C. GANA - Glass Association of North America - Glazing Manual.

D. NIJ Standard 0108.01 - (National Institute of Justice) Standard for Ballistic Resistant Protective Materials (September, 1985).

E. UL 752 - Standard for Bullet Resisting Equipment (January 27, 1995)

F. GSA TS01 - US General Services Administration Standard Test Method for Glazing

and Window Systems Subject to Dynamic Overpressure Loadings; 2003.

G. DOD UFC 4-010-01 - United Facilities Criteria (UFC) DOD Minimum Antiterrorism Standards for Buildings.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 31 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:
1. Submit shop drawings prepared by the manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
2. Include dimensioned elevation of each type opening assembly in project; indicate sizes and locations of hardware, and lites if specified.
3. Schedule: Indicate each opening assembly in project; cross-referenced to plans, elevations, and details.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified with a minimum documented experience of five years.

B. Installer Qualifications: Company specializing in installation of products specified with minimum three years documented experience.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color and finish are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
4. Accepted mock-ups shall be comparison standard for remaining Work

D. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

E. Coordination of Work: Coordinate layout and installation of components with other construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's unopened, undamaged packaging, with manufacturer's labels intact.

B. Remove wraps or covers from windows and frames upon delivery at the building site;

clean and touch-up scratches or disfigurement caused by shipping or handling promptly.

C. Store assemblies covered to protect them from damage but permitting air circulation.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Total Security Solutions, which is located at: 170 National Park Dr.; Fowlerville, MI 48836; Toll Free Tel: 888-839-6752; Tel: 517-223-7807; Fax: 517-223- 0805; Email:request info (info@tssbulletproof.com); Web:www.tssbulletproof.com

B. Requests for substitutions will be considered in accordance with provisions of Section 0160 00 - Product Requirements.

2.2 COMPONENTS

A. Extruded Aluminum: ASTM B 221; 6061 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B 209, 5005 alloy, H15 or H34 temper.

C. Sheet Steel: ASTM A 924/A 924M; galvanized to minimum G90.

D. Steel Sections: ASTM A 36/A3 6M; shaped to suit mullion sections, galvanized.

E. Internal framing fasteners Type Zinc Coated.

F. Neoprene glazing gaskets:
1. Interior Glazing gaskets closed cell cellular neoprene conforming to ASTM C 509 Type II Option 1 with a 40-50 Shore A Durometer.
2. Exterior Glazing gaskets solid neoprene conforming to ASTM C 864 with a 65-75 Shore A Durometer.

G. Weatherstripping: Entrance manufacturer's standard types to suit application.

H. Fasteners: Stainless steel or corrosion resistant steel.

2.3 BULLET RESISTANT STOREFRONT SYSTEMS

A. Bullet Resistant Fixed Sash System: Total Security Solutions Bullet Resistant Aluminum

Sash TSS-BL3-1.75 Window Framing System. Head and sill are one piece extrusions with no integral weep system at the sill. Jambs are two piece extrusion with removable faces to allow for reglazing. Mullions are three piece extrusion with removable faces to allow for glazing and individual lite replacement. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members. Glazing must not be removable from the threat side of the sash. Provide to dimension heights and widths indicated on the Drawings.

1. System shall be designed to defeat ballistic assaults from a 44 magnum handgun in accordance with UL 752, Level 3.
2. Aluminum Frames:
   a. Size: See drawings.
3. Glazing:
   a. Glazing to conform to UL 752 of the following protection level.
      1) Level 3
   b. Glazing Type:
      1) Acrylic
      2) Polycarbonate/Acrylic Laminate
      3) Glass/Polycarbonate Composite

B. Bullet Resistant Fixed Sash System: Total Security Solutions Bullet Resistant Aluminum Sash TSS-BL3-2.5 Window Framing System. Head and sill are one piece extrusions with no integral weep system at the sill. Jambs are two piece extrusion with removable faces to allow for reglazing. Mullions are three piece extrusion with removable faces to allow for glazing and individual lite replacement. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members. Glazing must not be removable from the threat side of the sash. Provide to dimension heights and widths indicated on the Drawings.

1. System shall be designed to defeat ballistic assaults from a 44 magnum handgun in accordance with UL 752, Level 3.
2. Aluminum Frames:
   a. Head, Sill and Jamb Size: See drawings.
   b. Mullion Size: See drawings.
3. Glazing:
   a. Glazing to conform to UL 752 of the following protection level.
      1) Level 3
   b. Glazing Type:
      1) Acrylic
      2) Polycarbonate/Acrylic Laminate
      3) Glass/Polycarbonate Composite

C. Bullet Resistant Door System: Total Security Solutions Bullet Resistant Aluminum TSS-BL3- DR Bullet Resistant Door System. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members. Corner joinery shall consist of heavy duty extruded and keyed aluminum corner splines with continuous 3/8 inch diameter tie rod construction. Glazing must not be removable from the threat side of the door. Provide to dimension heights and widths indicated on the Drawings.

1. System shall be designed to defeat ballistic assaults from a 44 magnum handgun in accordance with UL 752, Level 3.
2. Aluminum Doors:
   a. Top rail and stile: See drawings.
   b. Bottom rail including glass stops: See drawings.
3. Aluminum Door and Sidelight Frames and Extrusions:
   a. Size: See drawings.
   b. Structural sections shall be .125 inches thickness.

4. Glazing:
   a. LP-1250: Polycarbonate/Acrylic Laminate, nominal thickness 1-1/4 inch (30 mm), nominal weight 7.7 lbs/SF. Performance: UL 752, UL-3 (SPSA) 44 Mag. 240 Gr. Sp 13 50-1485 fps.
5. Door Hardware: See Section 08 71 00-Door Hardware

2.4 FACTORY FINISH

A. Provide aluminum finishes in accordance with Aluminum Association Standard AA DAF-45.

B. Clear Anodized Aluminum Surfaces: 204-R1 Class-II anodized aluminum coating.

C. Other Anodized Color: Colors to be verified with Architect and School system during Shop Drawing review.

PART 3 EXECUTION

3.1 GLAZING SCHEDULE: See Section 08 80 00.

3.2 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.3 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.4 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install plumb, level, square, true to line, and without warp or rack.

C. Provide all fasteners required for installation.

D. Anchor frames securely in place to supports. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.

E. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

F. Sheet Metal Flashing: Coordinate with sheet metal flashing as specified in Section 07 62 00 – Sheer Metal Flashing and Trim.

G. Joint Sealants: Install joint sealants as specified in Section 07 92 00- Joint Sealants.

H. Adjust door equipment for correct function and smooth operation.

I. Verify water and weather tight installation.

J. Remove temporary protection.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's representative to verify that installation is in conformance to the manufacturer's recommendations.

3.6 CLEANING

A. Clean interior and exterior glass surfaces promptly after installation in accordance with manufacturer's instructions.

B. Remove excess joint sealant in accordance with sealant manufacturer's instructions.

C. Do not use harsh cleaning materials or methods that would damage glazing or finish.

3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 14 21 00 - ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied But Not Installed Under this Section:

1. Hoist Beam
2. Pit Ladder
3. Inserts mounted in block walls for rail attachments

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator.
    a. One fused three phase permanent power in building electrical distribution room
    b. One non fused three phase permanent power in hoist way at top landing
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
9. Access Doors: As required for access to governor and/or seismic switch. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

D. Related sections:

1. Section 01 50 00 - Temporary Facilities and Controls
2. Section 03 30 00 - Cast-in-Place Concrete:
3. Section 04 20 00 - Unit Masonry
4. Section 05 50 00 - Metal Fabrications

5. Division 7 – Thermal and Moisture Protection
6. Division 23 - Mechanical
7. Division 26 - Electrical
8. Division 27 - Communications
9. Division 28 – Electronic Safety and Security
10. Division 31 - Earthwork

E. Industry and government standards:

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.2 DESCRIPTION OF ELEVATOR – PASSENGER ELEVATOR

A. Elevator Equipment: KONE MonoSpace® 300 gearless traction elevator

B. Equipment Control: KCM831

C. Drive: Non Regenerative

D. Quantity of Elevators: 1

E. Landings: 2 landings. See drawings.

F. Openings: 2 Front Openings, 0 Back Openings

G. Travel: 12' 5 5/8". See drawings.

H. Rated Capacity: 2500 lbs

I. Rated Speed: 150 fpm

J. Clear Inside Dimensions (W x D): 8' 4" x 5’ 9"

K. Cab Height: 7' 6"

L. Clear height under suspended ceiling: 7' 4"

M. Entrance Width and Type: 3' 6" and Side Opening

N. Entrance Height: 7' 0"

O. Main Power Supply: 208 V Volts + 5%, three-phase – Coordinate with Electrical work

P. Operation: Simplex

Q. Machine Location: Inside the hoistway mounted on car guide rail

R. Control Space Location: Integrated Controller

S. Elevator Equipment shall conform to the requirements of seismic zone: Non-seismic

T. Maintenance Service Period: 12 months

1.3 PERFORMANCE REQUIREMENTS

A. Car Performance

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.

2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance

1. Vertical Vibration (maximum): 15 mg

2. Horizontal Vibration (maximum): 12 mg

3. Jerk Rate (maximum): 1 m /sec3

4. Acceleration (maximum) .4 m/sec2

5. In Car Noise: = 55 dB(A)

6. Leveling Accuracy: ±0.2 inches

7. Starts per hour (maximum): 180

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.

2. Layout, finishes, and accessories and available options.

3. Controls, signals and operating system.

4. Color selection charts for cab and entrances.

B. Shop Drawings:

1. Clearances and travel of car.

2. Clear inside hoistway and pit dimensions.

3. Location and layout of equipment and signals.

4. Car, guide rails, buffers and other components in hoistway.

5. Maximum rail bracket spacing.

6. Maximum loads imposed on building structure.

7. Hoist beam requirements.

8. Location and sizes of access doors.

9. Location and details of hoistway door and frames.

10. Electrical characteristics and connection requirements.

C. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

D. Diagnostic Tools

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum of fifteen years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.6 DELIVERY, STORAGE AND HANDLING

A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.

B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.7 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.8 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service be performed during regular working hours of regular working days and shall include emergency 24-hour call back service.

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:

1. Basis of Design: MonoSpace® 300 traction elevators by KONE, Inc. (www.kone.com).

2. Other acceptable machine room-less products: manufacturer with minimum 15 years experience in manufacturing, installing, and servicing elevators of the type required for the project.

2.2 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.

2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.

3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.

4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. A separate control space should not be required.

2.3 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit

2. Terminal stopping switches.

3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.4 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances

1. Sills: extruded.

2. Doors: Hollow metal construction with vertical internal channel reinforcements.

3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.

4. Entrance Finish: Brushed Stainless Steel.

5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.5 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be all steel construction.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Steel Cab

1. Panels: Non-removable vertical panels, plastic laminate selected from standard manufacturer's catalog of choices.

2. Car Front Finish: Brushed stainless steel.

3. Car Door Finish: Brushed stainless steel.

4. Ceiling:

   a. Round LED Down Light Drop Ceiling - LF-88: Satin Finished Stainless Steel three panel suspended ceiling with two holes per panel for Round LED lights.

5. Handrail:

   a. Round tube brushed aluminum - 1.5 in.. Rails to be located on back wall of car enclosure.

6. Flooring: Selected by Architect. (Not to exceed 3lb/sqft and 1/2" finished depth.)

7. Threshold: Aluminum

E. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.

2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

F. Ventilation: No fan.

2.6 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation.

1. Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have amber illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be amber DOT-matrix. All texts, when illuminated, shall be amber. The car operating panel shall have a brushed stainless steel finish.

2. Additional features of car operating panel shall include:

   a. Car Position Indicator within operating panel (amber).

   b. Elevator Data Plate marked with elevator capacity and car number on car top.

   c. Help buttons with raised markings.

   d. In car stop switch per local code.

   e. Firefighter's hat.

   f. Firefighter's Phase II Key-switch.

   g. Call Cancel Button.

h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)

i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

j. Firefighter's Phase II emergency in-car operating instructions.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish.

1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature amber illumination.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.

D. Combination Hall Position Indicator and Hall Lantern located at Lobby. Hall lanterns and hall indicators shall feature amber illumination, all numbers will be amber display.

2.7 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

2. Zoned Car Parking.

3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation

2. Fan and Light Control.

3. Load Weighing Bypass.

4. Ascending Car Uncontrolled Movement Protection

5. Top of Car Inspection Station.

C. Additional Operating Features to include:

1. Emergency Battery Power Supply

a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller.

The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.

2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.

4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.

5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.

6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

7. Provide the means for the control to reset elevator earthquake operation.

2.8 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of Work, verify projections greater then 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less then 75 degrees from horizontal.

E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.2 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.3 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer’s recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

3.4 CONSTRUCTION

A. Interface with Other Work:

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.

2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.

    a. Ensure adequate support for entrance attachment points at all landings.

    b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.

    c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.

    d. Coordinate interface of elevators and fire alarm system.

    e. Coordinate interface of dedicated telephone line.

    f. Coordinate the installation of the non fused three phase permanent power disconnect in hoist way at top landing

3.5 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner’s Representative.

3.6 DEMONSTRATION

A. Prior to substantial completion, instruct Owner’s Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION 14 21 00

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SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Concrete bases.
9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.

D. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, spring clips, and chrome-plated finish.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
d. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with exposed-rivet hinge and spring clips .
e. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with spring clips.
f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 5000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 21 05 00

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SECTION 21 05 17 - 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 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 (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Smith, Jay R. Mfg. Co.

C. 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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

C. 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.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating,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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Presealed Systems.

C. 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.

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 (34.5-MPa), 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 (25-mm)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 (50 mm) 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 (6.4-mm) 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 (6.4-mm) 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 (50 mm) 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 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. 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. Concrete Slabs-on-Grade:
    a. Piping Smaller Than NPS 6 (DN 150) <: Galvanized-steel-pipe sleeves with sleeve-seal system
        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
2. Concrete Slabs above Grade:
    a. Piping Smaller Than NPS 6 (DN 150) Galvanized-steel-pipe sleeves

3. Interior Partitions:

    a. Piping Smaller Than NPS 6 (DN 150) <: Galvanized-steel-pipe sleeves] .

END OF SECTION 21 05 17

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SECTION 21 05 18 - 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 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

B. Split-Plate, Stamped-Steel Type: With chrome-plated finish, exposed-rivet hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.3 EXECUTION

2.4 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. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
    d. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.
    e. Bare Piping in Equipment Rooms: One-piece, stamped-steel type 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.

2.5 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

SECTION 21 13 13 - 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. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Excess-pressure pumps.
6. Alarm devices.
7. Manual control stations.
8. Control panels.
9. Pressure gages.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Standpipes" for standpipe piping.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Available fire-hydrant flow test records indicate the following conditions:

a. Date: To be performed.
b. Time:
c. Performed by: Qualified fire protection company..
d. Location of Flow Fire Hydrant F: 65 Parrot Road West Nyack, NY
e. Static Pressure at Residual Fire Hydrant R: Minimum 40 psig required..
f. Measured Flow at Flow Fire Hydrant F: Minimum 500 gpm required.
g. Residual Pressure at Residual Fire Hydrant R: Not less than 20 psig..

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
b. Mechanical Equipment Rooms: Ordinary Hazard, Group 1
c. Classrooms, Officeand Public Areas: Light Hazard.
d. Kitchens: Ordinary Hazard, Group 1.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.

4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft. (20.9 sq. m).
b. Storage Areas: 130 sq. ft. (12.1 sq. m).
c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and [ASCE/SEI 7] <Insert requirement>.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content and chemical components.

C. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

D. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. 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 piping.
2. HVAC hydronic piping.
3. Items penetrating finished ceiling include the following:

a. Lighting fixtures.
b. Air outlets and inlets.

4. HVAC Ductwork .

F. Qualification Data: For qualified Installer and professional engineer.

G. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

H. Welding certificates.

I. Fire-hydrant flow test report.

J. 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."

K. Field quality-control reports.

L. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 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 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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 PROJECT 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 Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

1.9 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.10 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. 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.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, 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 30, Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.

E. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

F. Galvanized , Steel Couplings: ASTM A 865, threaded.

G. Galvanized , Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

H. Malleable- or Ductile-Iron Unions: UL 860.

I. Cast-Iron Flanges: ASME 16.1, Class 125.

J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

K. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

L. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International, Inc.
    b. Corcoran Piping System Co.
    c. National Fittings, Inc.
    d. Shurjoint Piping Products.
    e. Tyco Fire & Building Products LP.
    f. Victaulic Company.

2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Galvanized, 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.

M. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

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. Victaulic Company.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-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 D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Anvil International, Inc.
    b. Victaulic Company.

3. Standard: UL 1091 except with ball instead of disc.
4. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
5. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
6. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. AFAC Inc.
b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
c. Anvil International, Inc.
d. Clow Valve Company; a division of McWane, Inc.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Crane Co.; Crane Valve Group; Stockham Division.
h. Fire-End & Croker Corporation.
i. Fire Protection Products, Inc.
j. Fivalco Inc.
k. Globe Fire Sprinkler Corporation.
l. Groeniger & Company.
m. Kennedy Valve; a division of McWane, Inc.
n. Matco-Norca.
o. Metraflex, Inc.
p. Milwaukee Valve Company.
q. Mueller Co.; Water Products Division.
r. NIBCO INC.
s. Potter Roemer.
t. Reliable Automatic Sprinkler Co., Inc.
u. Shurjoint Piping Products.
v. Tyco Fire & Building Products LP.
w. United Brass Works, Inc.
x. Venus Fire Protection Ltd.
y. Victaulic Company.
z. Viking Corporation.
aa. Watts Water Technologies, Inc.

3. Standard: UL 312.
4. Pressure Rating: 250 psig (1725 kPa) minimum.
5. Type: Swing check.
6. Body Material: Cast iron.
7. End Connections: Flanged or grooved.

D. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. Hammond Valve.
h. Milwaukee Valve Company.
i. Mueller Co.; Water Products Division.
j. NIBCO INC.
k. Shurjoint Piping Products.
l. Tyco Fire & Building Products LP.

m. United Brass Works, Inc.
n. Watts Water Technologies, Inc.

3. Standard: UL 262.
4. Pressure Rating: 250 psig (1725 kPa) minimum.
5. Body Material: Cast or ductile iron.
6. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Protection Products, Inc.
b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Affiliated Distributors.
b. Anvil International, Inc.
c. Barnett.
d. Conbraco Industries, Inc.; Apollo Valves.
e. Fire-End & Croker Corporation.
f. Fire Protection Products, Inc.
g. Flowserve.
h. FNW.
i. Jomar International, Ltd.
j. Kennedy Valve; a division of McWane, Inc.
k. Kitz Corporation.
l. Legend Valve.
m. Metso Automation USA Inc.
n. Milwaukee Valve Company.
o. NIBCO INC.
p. Potter Roemer.
q. Red-White Valve Corporation.
r. Southern Manufacturing Group.
s. Stewart, M. A. and Sons Ltd.
t. Tyco Fire & Building Products LP.
u. Victaulic Company.
v. Watts Water Technologies, Inc.

D. Plug 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. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

    a. Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
    b. High-Pressure Piping Specialty Valves: [250 psig (1725 kPa) minimum] [300 psig (2070 kPa)].

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawingsor comparable product by one of the following:

    a. AFAC Inc.
    b. Globe Fire Sprinkler Corporation.
    c. Reliable Automatic Sprinkler Co., Inc.
    d. Tyco Fire & Building Products LP.
    e. Venus Fire Protection Ltd.
    f. Victaulic Company.
    g. Viking Corporation.
3. Standard: UL 193.
4. Design: For horizontal or vertical installation.
5. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.

6. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
7. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. AFAC Inc.
    b. Reliable Automatic Sprinkler Co., Inc.

c. Tyco Fire & Building Products LP.

3. Standard: UL 1726.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Type: Automatic draining, ball check.
6. Size: NPS 3/4 (DN 20).
7. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. Fire-End & Croker Corporation.
d. Fire Protection Products, Inc.
e. GMR International Equipment Corporation.
f. Guardian Fire Equipment, Inc.
g. Tyco Fire & Building Products LP.
h. Wilson & Cousins Inc.

3. Standard: UL 405.
4. Type: Exposed, projecting, for wall mounting.
5. Pressure Rating: 175 psig (1200 kPa) minimum.
6. Body Material: Corrosion-resistant metal.
7. 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.
8. Caps: Brass, lugged type, with gasket and chain.
9. Escutcheon Plate: Round, brass, wall type.
10. Outlet: Back, with pipe threads.
11. Number of Inlets: Two.
12. Escutcheon Plate Marking: Similar to " AUTO SPKR."
13. Finish: Rough brass or bronze or Rough chrome plated.
14. Outlet Size: NPS 4 (DN 100).

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. National Fittings, Inc.
c. Shurjoint Piping Products.

d. Tyco Fire & Building Products LP.
e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T 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, provide products by one of the following:

a. AGF Manufacturing Inc.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
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.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Brass Mfg. Company, Inc.
b. Fire-End & Croker Corporation.
c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175 psig (1200 kPa).
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, provide products by one of the following:

a. AGF Manufacturing Inc.
b. Triple R Specialty.

c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
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, provide products by one of the following:

a. CECA, LLC.
b. Corcoran Piping System Co.
c. Merit Manufacturing; a division of Anvil International, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 250 psig (1725 kPa) minimum.
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.

F. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, 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 (1200 kPa) minimum.
5. Size: Same as connected piping, for sprinkler.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.

7. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

1. Characteristics:

a. Nominal 1/2-inch (12.7-mm) Orifice: With Discharge Coefficient K between 5.3 and 5.8.

E. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

F. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

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, two piece, with 1-inch (25-mm) vertical adjustment
2. Sidewall Mounting: Chrome-plated steelone piece, flat.

H. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc.
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. Globe Fire Sprinkler Corporation.

b. Tyco Fire & Building Products LP.

c. Victaulic Company.

d. Viking Corporation.

e. <Insert manufacturer's name>.

2. Standard: UL 753.

3. Type: Mechanically operated, with Pelton wheel.

4. Alarm Gong: Cast aluminum with red-enamel factory finish.

5. Size: 10-inch (250-mm) diameter.

6. Components: Shaft length, bearings, and sleeve to suit wall construction.

7. Inlet: NPS 3/4 (DN 20).

8. Outlet: NPS 1 (DN 25) drain connection.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ADT Security Services, Inc.

b. McDonnell & Miller; ITT Industries.

c. Potter Electric Signal Company.

d. System Sensor; a Honeywell company.

e. Viking Corporation.

f. Watts Industries (Canada) Inc.

2. Standard: UL 346.

3. Water-Flow Detector: Electrically supervised.

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 (1725 kPa).

7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. AFAC Inc.

b. Barksdale, Inc.

c. Detroit Switch, Inc.

d. Potter Electric Signal Company.

e. System Sensor; a Honeywell company.

f. Tyco Fire & Building Products LP.

g. United Electric Controls Co.

h. 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, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.

b. Kennedy Valve; a division of McWane, Inc.

c. Potter Electric Signal Company.

d. System Sensor; a Honeywell company.

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.

2.11 MANUAL CONTROL STATIONS

A. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.12 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.

1. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.

2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.13 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.

2. Ashcroft, Inc.

3. Brecco Corporation.

4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

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.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping."

B. Install shutoff valve, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

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 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) 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.

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.

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 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

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 Division 21 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Division 21 Section "Fire-Suppression Systems Insulation."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 21 Section "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 Division 21 Section "Escutcheons for Fire-Suppression Piping."

3.5 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 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) 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.

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.

3.7 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.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3. Deluge Valves: Install 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.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of[narrow dimension 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.

3.9 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-Place Concrete.".

1. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications.".

C. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.10 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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. Start and run excess-pressure pumps.

6. Coordinate with fire-alarm tests. Operate as required.

7. Coordinate with fire-pump tests. Operate as required.

8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.13 DEMONSTRATION

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

3.14 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

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 the following:

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 to NPS 4 (DN 65 to DN 100), shall be the following:

1. Schedule 30, 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.

3.15 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers .

2. Rooms with Suspended Ceilings: Upright and concealed sprinklers as indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

2. Upright Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.

3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Available Manufacturers:

a. NIBCO INC.

b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated] finish.

i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

        1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 22 05 00

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SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase general-purpose, small squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 05 13

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.

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. 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. 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. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. 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 interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 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 (34.5-MPa), 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 (25-mm) 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. 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 (50 mm) 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 (6.4-mm) 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 (6.4-mm) 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 (50 mm) 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 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. 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 below Grade: Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
   2. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs above Grade: Stack-sleeve fittings.

END OF SECTION 22 05 17

SECTION 22 05 18 - ESCUTCHEONS 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.

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.

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 type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

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 Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
d. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. 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 22 05 18

SECTION 22 05 19 - 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. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.

B. Related Sections:

1. Division 21 Section "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Division 21 fire-suppression piping Sections for fire-protection pressure gages.
3. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
4. Division 22 Section " Domestic Water Piping" for water meters inside the building.

1.3 SUBMITTALS

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

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Ashcroft or comparable product by one of the following:

1. Ernst Flow Industries.
2. Marsh Bellofram.
3. Miljoco Corporation.
4. Nanmac Corporation.
5. Noshok.
6. Palmer Wahl Instrumentation Group.
7. REOTEMP Instrument Corporation.
8. Tel-Tru Manufacturing Company.
9. Trerice, H. O. Co.
10. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
11. Weiss Instruments, Inc.
12. WIKA Instrument Corporation - USA.
13. Winters Instruments - U.S.

C. Standard: ASME B40.200.

D. Case: sealed type; stainless steel with 3-inch (76-mm) nominal diameter.

E. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F

F. Connector Type(s): Union joint, adjustable angle with unified-inch screw threads.

G. Connector Size: 1/2 inch (13 mm) with ASME B1.1 screw threads.

H. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.

I. Window: Plain glass or plastic.

J. Ring: Stainless steel.

K. Element: Bimetal coil.

L. Pointer: Dark-colored metal.

M. Accuracy: Plus or minus 1percent of scale range.

2.2 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. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.

10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Ashcroft.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Ashcroft or comparable product by one of the following:
   a. AMETEK, Inc.; U.S. Gauge.
   b. Ernst Flow Industries.
   c. Flo Fab Inc.
   d. Marsh Bellofram.
   e. Miljoco Corporation.
   f. Noshok.
   g. Palmer Wahl Instrumentation Group.
   h. REOTEMP Instrument Corporation.
   i. Tel-Tru Manufacturing Company.
   j. Trerice, H. O. Co.
   k. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   l. Weiss Instruments, Inc.
   m. WIKA Instrument Corporation - USA.
   n. Winters Instruments - U.S.
3. Standard: ASME B40.100.
4. Case: Sealed type(s); cast aluminum or drawn steel ; 6-inch (152-mm) nominal diameter.
5. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
6. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
9. Pointer: Dark-colored metal.
10. Window: Glass or plastic.
11. Ring: Metal
12. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15) , ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, by one of the available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Flow Design.

B. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

C. Description: Test-station fitting made for insertion into piping tee fitting.

D. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

E. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.

F. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C) .

G. Core Inserts: Chlorosulfonated polyethylene synthetic self-sealing rubber.

2.6 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Hayes Fluid Controls.

B. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

C. 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.

D. Low-Range Thermometer: Small, bimetallic insertion type with1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C)

E. High-Range Thermometer: Small, bimetallic insertion type with1- to 2-inch- (25- to 51-mm-)diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).

F. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).

G. Carrying Case: Metal or plastic, with formed instrument padding.

2.7 SIGHT FLOW INDICATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dwyer Instruments or comparable product by one of the following:

1. Archon Industries, Inc.
2. Emerson Process Management; Brooks Instrument.
3. Ernst Co., John C., Inc.
4. Ernst Flow Industries.
5. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
6. OPW Engineered Systems; a Dover company.
7. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

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: 25 psig (860 kPa).

E. Minimum Temperature Rating: 200 deg F (93 deg C).

F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter to center of pipe 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.
4. Inlet and outlet of each remote domestic water chiller.

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.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Liquid-filled , bimetallic-actuated type.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. 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 (Minus 20 to plus 50 deg C).

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Sealed direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Sealed, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.

END OF SECTION 22 05 19

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SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Bronze gate valves.
6. Iron gate valves.
7. Bronze glove 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.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

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: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

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

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.

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 angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. 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.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.

3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

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. 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. DynaQuip Controls.
   d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
   e. Hammond Valve.
   f. Jamesbury; a subsidiary of Metso Automation.
   g. Jomar International, LTD.
   h. Kitz Corporation.
   i. Legend Valve.
   j. Marwin Valve; a division of Richards Industries.
   k. Milwaukee Valve Company.
   l. NIBCO INC.
   m. Red-White Valve Corporation.
   n. RuB Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.

j. Port: Full.

B. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
   d. Hammond Valve.
   e. Jamesbury; a subsidiary of Metso Automation.
   f. Kitz Corporation.
   g. Marwin Valve; a division of Richards Industries.
   h. Milwaukee Valve Company.
   i. RuB Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Hammond Valve.
   e. Lance Valves; a division of Advanced Thermal Systems, Inc.
   f. Legend Valve.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Red-White Valve Corporation.
   j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.

h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conb
   b. raco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Hammond Valve.
   e. Lance Valves; a division of Advanced Thermal Systems, Inc.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. American Valve, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Division.
   e. Hammond Valve.
   f. Kitz Corporation.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Powell Valves.
   j. Red-White Valve Corporation.
   k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   l. Zy-Tech Global Industries, Inc.
2. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.

e. Ends: Threaded.
f. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. American Valve, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Division.
   e. Hammond Valve.
   f. Kitz Corporation.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Powell Valves.
   j. Red-White Valve Corporation.
   k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   l. Zy-Tech Global Industries, Inc.
2. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. American Valve, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Division.
   e. Hammond Valve.
   f. Kitz Corporation.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Powell Valves.
   j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   k. Zy-Tech Global Industries, Inc.
2. Description:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.

e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Hammond Valve.
   d. Kitz Corporation.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Powell Valves.
   h. Red-White Valve Corporation.
   i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   j. Zy-Tech Global Industries, Inc.
2. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.
   e. Stem and Disc: Bronze.
   f. Packing: Asbestos free.
   g. Handwheel: Malleable iron.

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 check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass, bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125 , metal seats.
4. Iron Gate Valves: Class 125 , OS&Y.

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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. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related 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.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

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.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. 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: 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 stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 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 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

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
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. Flex-Strut Inc.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut Corporation; Tyco International, Ltd.
   g. Wesanco, Inc.
3. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
4. Standard: MFMA-4.
5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

8. Metallic Coating: Hot-dipped galvanized .
9. Paint Coating: Acrylic.
10. Plastic Coating: PVC.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. Empire Industries, Inc.
   c. ERICO International Corporation.
   d. Haydon Corporation; H-Strut Division.
   e. NIBCO INC.
   f. PHD Manufacturing, Inc.
   g. PHS Industries, Inc.
3. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
4. Standard: Comply with MFMA-4.
5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Coating: Zinc.

2.5 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Allied Tube & Conduit.
2. Champion Fiberglass, Inc.
3. Cooper B-Line, Inc.
4. SEASAFE, INC.; a Gibraltar Industries Company.

C. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass channel with inturned lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa)or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa)]minimum compressive strength and vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa)or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.7 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.

2.8 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.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. Curb-Mounting-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.

2.9 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.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.11 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 (34.5-MPa), 28-day compressive strength.

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. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

I. 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.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. 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.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. 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 (DN 65) 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.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. 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.

Q. 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 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) 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 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.

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 (40 mm).

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 (0.05 mm).

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.

3.6 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 and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

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 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), 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 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
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 (DN 100 to DN 900), 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 (DN 100 to DN 900), 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 (DN 65 to DN 900) 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 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), 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 (DN 50 to DN 1050) 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 (DN 50 to DN 600) 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 (DN 50 to DN 750) 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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) 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.
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 (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).
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 (32 mm).
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.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

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 [powder-actuated fasteners] [or] [mechanical-expansion anchors] instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

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. Valve tags.
5. 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm)thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 cover full 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 (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Stainless steel, 0.025-inch (0.64-mm) 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 (A4) 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.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).
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 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "[Interior Painting] [High-Performance Coatings]."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:
   a. Background Color: Green .
   b. Letter Color: White.
2. Sanitary Waste and Storm Drainage Piping:
   a. Background Color: Green .
   b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; 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: 2 inches (50 mm), round.
   b. Hot Water: 2 inches (50 mm)], round.
2. Valve-Tag Color:
   a. Cold Water: Natural.
   b. Hot Water: Natural.
3. Letter Color:

a. Cold Water: Black.
b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

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SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.

1.3 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. Qualification Data: For qualified Installer.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. 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. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of 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 (454 Deg C) 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 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   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.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

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-30.
   b. Eagle Bridges - Marathon Industries; 501.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
   d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.4 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.

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.

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.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 2 inches (50 mm) 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.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. 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.

3.4 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. 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 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "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, and Unions:

1. Install insulation over fittings, valves, strainers, 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 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. Label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When union covers are made from sectional pipe insulation, extend insulation from union long at least two times the insulation thickness over adjacent pipe insulation on each side of union. Secure cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for unions, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 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 (150 mm) 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 Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. 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.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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, and three locations of threaded valves.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 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.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

END OF SECTION 22 07 19

SECTION 22 11 13 - FACILITY WATER DISTRIBUTION 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 water-distribution piping and related components outside the building for water service.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PA: Polyamide (nylon) plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

H. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 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. Wiring Diagrams: Power, signal, and control wiring for alarms.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 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.

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. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare 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. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. 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.

2.2 JOINING MATERIALS

A. Refer to Division 22 Section "Common Work Results for Plumbing" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.

1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
2. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure to suit system pressures.
3. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
    a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure to suit system pressures.
4. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
5. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types, and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:

1. Standards: ASTM A 674 or AWWA C105.
2. Form: Tube.
3. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
4. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness, or high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
5. Material: High-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
6. Color: Natural.

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
    a. American AVK Co.; Valves & Fittings Div.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. East Jordan Iron Works, Inc.
    f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    g. McWane, Inc.; Kennedy Valve Div.
    h. McWane, Inc.; M & H Valve Company Div.
    i. McWane, Inc
    j. .; Tyler Pipe Div.; Utilities Div.
    k. Mueller Co.; Water Products Div.
    l. NIBCO INC.
    m. U.S. Pipe and Foundry Company.
4. Nonrising-Stem, Metal-Seated Gate Valves:
    a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
        1) Standard: AWWA C500.
        2) Minimum Pressure Rating: 200 psig (1380 kPa).
        3) End Connections: Mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
    a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    b. East Jordan Iron Works, Inc.
    c. Flowserve.
    d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    e. McWane, Inc.; Kennedy Valve Div.
    f. McWane, Inc.; M & H Valve Company Div.
    g. Mueller Co.; Water Products Div.
    h. U.S. Pipe and Foundry Company.
4. Description: Sleeve and valve compatible with drilling machine.
    a. Standard: MSS SP-60.

b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, [metal] [resilient]-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.7 WATER METERS

A. Water meters will be furnished by utility company.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, 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 NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be any of the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.

F. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 (DN 20 to DN 50) shall be same as underground water-service piping.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, metal seated gate valves with valve box.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) 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 (DN 50) 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.

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. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches (910 mm) cover over top.

F. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

H. Sleeves are specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

I. Mechanical sleeve seals are specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

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.

K. See Division 21 Section "Water-Based Fire-Suppression Systems" for fire-suppression-water piping inside the building.

L. See Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results for Plumbing" for joining piping of dissimilar metals.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
4. 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. MSS Valves: Install as component of connected piping system.

3.9 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 22 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.

C. Connect water-distribution piping to existing water main

D. Connect water-distribution piping to interior domestic waterpiping.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.11 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

3.12 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13

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. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Water meters furnished by utility company for installation by Contractor.
5. Water meters.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Vacuum breakers.
5. Water penetration systems.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Water Samples: Specified in "Cleaning" Article.

D. 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. Domestic water piping.

E. 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 14 for plastic, potable domestic water piping and components.

C. 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 Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Architect's Owner's written permission.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
3. 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.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) 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.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Tube.

C. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.

D. Color: Black or Natural.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cascade Waterworks Manufacturing.
   b. Dresser, Inc.; Dresser Piping Specialties.
   c. Ford Meter Box Company, Inc. (The).
   d. JCM Industries.
   e. Romac Industries, Inc.
   f. Smith-Blair, Inc; a Sensus company.
   g. Viking Johnson; c/o Mueller Co.

2.6 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, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.

c. EPCO Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:
   a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
   b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Perfection Corporation; a subsidiary of American Meter Company.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Company.
2. Description:
   a. Electroplated steel nipple complying with ASTM F 1545.
   b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C)
   c. End Connections: Male threaded or grooved.
   d. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

H. Install domestic water piping level without pitch and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. 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.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping adjacent to equipment and specialties to allow service and maintenance.

N. Install piping to permit valve servicing.

O. 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.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

T. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

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."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. 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."

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions or nipples.

3.7 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 (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet (30 m) If Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) 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 (10 mm).

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
   6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
   7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.9 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.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 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 (50 mg/L) 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 (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 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 piping, NPS 2 (DN 50) and smaller, shall be the following:

1. Hard or soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 3 (DN 50) and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought- copper solder-joint fittings; and soldered joints.

3.14 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrate 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.

END OF SECTION 22 11 16

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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. Balancing valves.
3. Temperature-actuated water mixing valves.
4. Strainers.
5. Outlet boxes.
6. Hose bibbs.
7. Drain valves.
8. Water hammer arresters.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.
3. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
4. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig (860 kPa)** unless otherwise indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. 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 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. FEBCO; SPX Valves & Controls.
e. Rain Bird Corporation.
f. Toro Company (The); Irrigation Div.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Plumbing Products Group; Wilkins Div.

3. Standard: ASSE 1001.
4. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: **Chrome plated**.

2.2 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves :

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Industries; Bell & Gossett Div.
    d. NIBCO INC.
    e. TAC Americas.
    f. Taco, Inc.
    g. Watts Industries, Inc.; Water Products Div.

4. Type: **Ball** valve with two readout ports and memory setting indicator.
5. Body: **Brass or bronze**,
6. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
7. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

C. Memory-Stop Balancing Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. Hammond Valve.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corp.

3. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
4. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
5. Size: NPS 2 (DN 50) or smaller.
6. Body: Copper alloy.
7. Port: Standard or full port.
8. Ball: Chrome-plated brass.
9. Seats and Seals: Replaceable.
10. End Connections: Solder joint or threaded.
11. Handle: Vinyl-covered steel with memory-setting device.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Honeywell Water Controls.
    d. Lawler Manufacturing Company, Inc.
    e. Leonard Valve Company.
    f. Powers; a Watts Industries Co.
    g. Watts Industries, Inc.; Water Products Div.
    h. Zurn Plumbing Products Group; Wilkins Div.

3. Standard: ASSE 1016, thermostatically controlled water tempering valve.
4. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded.
8. Finish: Rough or chrome-plated bronze.
9. Tempered-Water Setting: 100**deg F (deg C).**>
10. Tempered-Water Design Flow Rate: **1 gpm (L/s).**>

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers <:

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast ironfor NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 (DN 50) and Smaller: **0.033 inch (0.84 mm)**
    b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): **0.062 inch (1.57 mm)** >.

6. Drain: **Factory-installed, hose-end drain valve**.

2.5 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company.
    b. Guy Gray Manufacturing Co., Inc.
    c. IPS Corporation.
    d. LSP Products Group, Inc.

e. Oatey.
f. Plastic Oddities; a division of Diverse Corporate Technologies.
g. Symmons Industries, Inc.
h. Watts Industries, Inc.; Water Products Div.
i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
j. Zurn Plumbing Products Group; Light Commercial Operation.

3. Mounting: Recessed.
4. Material and Finish: **Enameled-steel or epoxy-painted-steel** box and faceplate.
5. 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.
6. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
7. Drain: **NPS 2 (DN 50)** standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
9. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

2.6 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 (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL, Inc.
b. Josam Company.
c. MIFAB, Inc.
d. PPP Inc.
e. Sioux Chief Manufacturing Company, Inc.

f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
g. Tyler Pipe; Wade Div.
h. Watts Drainage Products Inc.
i. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: **Copper tube with piston**.
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves **and bypass with memory-stop balancing valve**. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each **control valve and pump**].

G. Install outlet boxes recessed in wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201.

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. Calibrated balancing valves.
   Outlet boxes.

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** 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 flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19

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SECTION 22 11 23 - 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.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.5 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

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 rigging instructions for handling.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings > or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. Grundfos Pumps Corp.
4. TACO Incorporated.
5. WILO USA LLC - WILO Canada Inc.

C. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

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. Casing: Bronze, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

E. Capacities and Characteristics:

1. Capacity: 76 gpm .
2. Total Dynamic Head: 52.5 feet .
3. Minimum Working Pressure: 125 psig (860 kPa).
4. Maximum Continuous Operating Temperature: 220 deg F (104 deg C).
5. Inlet and Outlet Size: 1.5 inch.
6. Pump Speed: 3450 rpm>.
7. Pump Control: Thermostat.
8. Motor Horsepower: <Insert value>.
9. Electrical Characteristics:
    a. Volts: 120.
    b. Phases: Single.
    c. Hertz: 60.
    d. Full-Load Amperes: 5.8

2.2 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. Thermostats: Electric; adjustable for control of [hot-water circulation] <Insert application> pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F (18 to 93 deg C)
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.
7. Settings: Start pump at 110 deg F & 130 deg F and stop pump at 120 deg F & 140 deg F .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Install pressure switches in water supply piping.

E. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
   a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
2. 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 valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."
3. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

D. Comply with Division 26 Sections for electrical connections, and wiring methods.

E. Connect thermostats to pumps that they control.

F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

A. 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 for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:
   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.
6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.

7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.6 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23

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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.
3. Encasement for underground metal piping.

B. Related Sections:

1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.4 SUBMITTALS

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

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

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 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 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.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Extra Heavy class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.

b. Clamp-All Corp.

c. Dallas Specialty & Mfg. Co.

d. MIFAB, Inc.

e. Mission Rubber Company; a division of MCP Industries, Inc.

f. Stant.

g. 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.

C. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. MG Piping Products Company.

2. Standard: ASTM C 1277.

3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 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 coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. 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.

L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller;2 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.

3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

P. Install force mains at elevations indicated.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."

2. 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."

3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. 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."

T. 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."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

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: Unshielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:
   a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
   b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
3. Install gate valve for piping NPS 2-1/2 (DN 65) 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 Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

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 (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
6. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

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 drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage 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 drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.

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 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

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 (30 kPa). 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 (250 Pa). 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:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) 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.
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. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Hubless, cast-iron soil pipe and fittings ;heavy-duty hubless-piping couplings; and coupled joints.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Extra Heavy, Hub and Spigot, cast iron soil piping; gaskets, and gasketed joints.

F. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Extra Heavy, Hub and Spigot, cast iron soil piping; gaskets, and gasketed joints.

END OF SECTION 22 13 16

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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. Floor drains.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.
7. FOG disposal systems.
8. Grease interceptors.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
2. Division 22 Section "Plumbing Fixtures" for hair interceptors.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. 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.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that grease interceptors accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. 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.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cultures: Provide 1-gal. (3.8-L) bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 1-gal. (3.8-L) bottles.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.14.1.
5. Size: Same as connected piping.
6. Body: Cast iron.
7. Cover: Cast iron with bolted or threaded access check valve.
8. End Connections: Hub and spigot.
9. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
10. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

g. Josam Company; Blucher-Josam Div.

4. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
5. Size: Same as connected drainage piping
6. Body Material: cast-iron soil pipe test tee required to match connected piping.
7. Closure: Raised-head, cast-iron plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
9. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Josam Company; Josam Div.
   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.
   i. Josam Company; Josam Div.
   j. Kusel Equipment Co.
   k. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   l. Josam Company; Blucher-Josam Div.
4. Standard: ASME A112.36.2M for heavy-duty, adjustable housing.
5. Size: Same as connected branch.
6. Body or Ferrule: Cast iron.
7. Clamping Device: Not required.
8. Outlet Connection: Spigot.
9. Closure: Brass plug with straight threads and gasket.
10. Adjustable Housing Material: Cast iron with threads.
11. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
12. Frame and Cover Shape: Round.
13. Top Loading Classification: Heavy Duty.
14. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
15. Standard: ASME A112.3.1.
16. Size: Same as connected branch.
17. Housing: Stainless steel.
18. Closure: Stainless steel with seal.
19. Riser: Stainless-steel drainage pipe fitting to cleanout.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains :

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
    a. Commercial Enameling Co.
    b. Josam Company; Josam Div.
    c. MIFAB, Inc.
    d. Prier Products, Inc.
    e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Tyler Pipe; Wade Div.
    g. Watts Drainage Products Inc.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.6.3.
5. Pattern: Floor drain.
6. Body Material: Gray iron.
7. Seepage Flange: Required.
8. Anchor Flange: Required.
9. Clamping Device: Required.
10. Outlet: Bottom.
11. Backwater Valve: Drain-outlet type
12. Coating on Interior and Exposed Exterior Surfaces: Not required.
13. Sediment Bucket: Not required
14. Top or Strainer Material: Nickel bronze.
15. Top of Body and Strainer Finish: Nickel bronze.
16. Top Shape: Round.
17. Dimensions of Top or Strainer: 6”
18. Top Loading Classification: Heavy Duty.
19. Funnel: Not required.
20. Inlet Fitting: Not required.
21. Trap Material: Cast iron.
22. Trap Pattern: Deep-seal P-trap.
23. Trap Features: Not required.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. ProSet Systems Inc.
3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
4. Size: Same as connected soil, waste, or vent stack.
5. 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.

6. 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.
7. Special Coating: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. 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 (DN 50): 4-inch- (100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm) thickness.
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm) thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.7 GREASE INTERCEPTORS

A. Grease Interceptors

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Highland Tank or a comparable product by one of the following:
   a. Applied Chemical Technology, Incorporated.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Rockford Sanitary Systems, Inc.
   e. Schier Products Company.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products Inc.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.
   j. Ashland Trap Distribution Co.
   k. Bio-Microbics, Inc.
   l. Canplas LLC.
   m. Schier Products Company.
   n. Zurn Plumbing Products Group; Light Commercial Operation.
4. Standard: ASME A112.14.3[and PDI-G101], for intercepting and retaining fats, oils, and greases from food preparation and processing
5. Plumbing and Drainage Institute Seal: Required].
6. Body Material: [Cast iron] [Cast iron or steel]
7. Interior Lining: [Corrosion-resistant enamel]
8. Exterior Coating: [Corrosion-resistant enamel]
9. Body Dimensions: 48” dia x 12’-4”L
10. Grease Retention Capacity: 1,000 gallons
11. Inlet and Outlet Size: 4”
12. End Connections: Hub
13. Cleanout: Integral
14. Mounting: Exterior, below grade.
15. Flow-Control Fitting: Not required
16. Operation: Manual cleaning

2.8 Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser, with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
   b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
   c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) 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. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

H. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

I. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Install fixture air-admittance valves on fixture drain piping.

L. Install stack air-admittance valves at top of stack vent and vent stack piping.

M. Install air-admittance-valve wall boxes recessed in wall.

N. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

O. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

P. Install through-penetration firestop assemblies in plastic conductors at floor penetrations.

Q. Install deep-seal traps on floor drains and other waste outlets, if indicated.

R. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

S. Install vent caps on each vent pipe passing through roof.

T. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

U. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

V. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

W. Assemble components of FOG disposal systems and install on floor. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.

X. Install wood-blocking reinforcement for wall-mounting-type specialties.

Y. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

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.

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. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) 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 (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) 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 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled FOG disposal systems and their installation, including piping and electrical connections, and to assist in testing.

B. 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.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain FOG disposal systems. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 13 19

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SECTION 22 14 13 - 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. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Division 22 Section "Sump Pumps" for storm drainage pumps.
2. Division 33 Section "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 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 (30 kPa) .

1.4 SUBMITTALS

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

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Shop Drawings: For siphonic roof drainage system. Include calculations, plans, and details.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage 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 no fewer than two days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without Construction Manager'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.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Extra Heavy classes.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. Dallas Specialty & Mfg. Co.
   d. MIFAB, Inc.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Stant.
   g. 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.

B. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MG Piping Products Company.
2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 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 from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. 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.

L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

O. Install engineered siphonic drain specialties and storm drainage piping in locations indicated.

P. Install force mains at elevations indicated.

Q. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Storm Drainage Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. 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."

T. 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."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steelpipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steelpipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steelpipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:
    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) pipe lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor
3. Comply with requirements for backwater valves cleanouts and drains specified in Division 22 Section "Storm Drainage Piping Specialties."

D. Connect force-main piping to the following:

1. Storm Sewer: To exterior force main.
2. Sump Pumps: To sump 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 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
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 storm drainage 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 storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping 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 (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) 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.
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.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.

C. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:

1. Extra Heavy class, Hun and Spigot, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

D. Underground, storm drainage piping NPS 8 (DN 200) and larger shall be the following:

1. Extra Heavy class, Hun and Spigot, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

END OF SECTION 22 14 13

SECTION 22 14 23 - STORM DRAINAGE 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:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Through-penetration firestop assemblies.
5. Flashing materials.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Josam Company.
b. Marathon Roofing Products.
c. MIFAB, Inc.
d. Smith, Jay R. Mfg. Co.
e. Tyler Pipe.
f. Watts Water Technologies, Inc.

g. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.6.4, for general-purpose roof drains.
4. Body Material: Cast iron.
5. Dimension of Body: Nominal 14-inch (357-mm) diameter.
6. Combination Flashing Ring and Gravel Stop: Required.
7. Flow-Control Weirs: Required.
8. Outlet: Bottom.
9. Extension Collars: Not required.
10. Underdeck Clamp: Not required.
11. Expansion Joint: Not required.
12. Sump Receiver Plate: Required.
13. Dome Material: Cast iron.
14. Perforated Gravel Guard: Stainless steel.
15. Vandal-Proof Dome: Not required.
16. Water Dam: 2 inches (51 mm) high.

B. Metal, Medium-Sump, Promenade Roof Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.6.4, for promenade roof drains.
4. Body Material: Cast iron.
5. Dimension of Body: 11- to 12-inch (280- to 305-mm) diameter.
6. Dimension of Frame and Grate: Nominal 12 inches (305 mm)square.
7. Outlet: Bottom.
8. Grate Material: Cast iron.
9. Vandal-Proof Grate: Not required.
10. Extension Collars: Not required.
11. Underdeck Clamp: Not required.
12. Expansion Joint: Not required.
13. Sump Receiver Plate: Not required.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adaptors

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

B. Downspout Boots

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.

2. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.

C. Conductor Nozzles

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.3 CLEANOUTS

A. Test Tees :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provideor comparable product by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
4. Size: Same as connected drainage piping.
5. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure Plug: raised head.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
   a. ProSet Systems Inc.
3. Standard: ASTM E 814, for through-penetration firestop assemblies.
4. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
5. Size: Same as connected pipe.
6. 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.
7. 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.
8. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07 Sections.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots above the first floor ceiling height, Secure to building wall.

D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Install test tees in vertical conductors and near floor.

I. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

J. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.

K. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) 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 the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) 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. Fabricate and install flashing and pans, sumps, and other drainage shapes.

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 22 14 23

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.

B. Related Section:

1. Division 22 Section "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 SUBMITTALS

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

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Barnes; Crane Pumps & Systems.
    b. Bell & Gossett Domestic Pump; ITT Corporation.
    c. Flo Fab inc.
    d. Glentronics, Inc.
    e. Goulds Pumps; ITT Corporation.
    f. Grundfos Pumps Corp.
    g. Liberty Pumps.
    h. Little Giant Pump Co.
    i. McDonald, A. Y. Mfg. Co.
    j. Pentair Pump Group; Hydromatic Pumps.
    k. Pentair Pump Group; Myers.
    l. Stancor, Inc.
    m. Sta-Rite Industries, Inc.
    n. Weil Pump Company, Inc.
    o. Weinman Division; Crane Pumps & Systems.
    p. Zoeller Company.
    q.

3. Description: Factory-assembled and -tested sump-pump unit.
4. 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.
5. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
6. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron design for clear wastewater handling, and keyed and secured to shaft.
7. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
8. Seal: Mechanical.
9. 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.

    a. Motor Housing Fluid: Air.

10. Controls:

    a. Enclosure: NEMA 250, Type 4X
    b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.

d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. Controls:

a. Enclosure: NEMA 250, Type 4X wall-mounted.
b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

12. Control-Interface Features:

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

A. Unit Capacity: 34 gpm .

B. Number of Pumps: One.

C. Each Pump:

1. Capacity: 57 gpm .
2. Total Dynamic Head: 20feet .
3. Speed: 3450 RPM.
4. Discharge Size: 1 1/2 INCH
5. Electrical Characteristics:

a. Motor Horsepower: 1/3.
b. Volts: 120.
c. Phases: Single.
d. Hertz: 60.

D. Unit Electrical Characteristics:

1. Full-Load Amperes: 2.9 A
2. Minimum Circuit Ampacity: 10A

2.3 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."

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.

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. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. 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.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

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 22 14 29

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SECTION 22 20 00 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.

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 (690 kPa) minimum unless otherwise indicated.
2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).

Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) (allowable in boiler rooms), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less throughout the remainder of the building.

B. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. 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: 1/4 inch per foot (1:50).
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

E. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

F. Qualification Data: For qualified professional engineer.

G. Welding certificates.

H. Field quality-control reports.

I. Operation and Maintenance Data: For motorized gas valves, pressure regulators and service meters 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.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 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 Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
Lapped Face: Not permitted underground.
c. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
d. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
6. Mechanical Couplings:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.
b. Stainless-steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Stainless-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. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm).

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig (862 kPa).
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.

d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Maxon.
b. Dungs, Karl, Inc.
c. Eaton Corporation; Controls Div.
d. Eclipse Combustion, Inc.
e. Honeywell International Inc.
f. Johnson Controls.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.

6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASCO Power Technologies, LP; Division of Emerson.
   b. Dungs, Karl, Inc.
   c. Eclipse Combustion, Inc.
   d. Goyen Valve Corp.; Tyco Environmental Systems.
   e. Magnatrol Valve Corporation.
   f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
   g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   d. Invensys.
   e. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.

9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig (13.8 kPa).

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 1 psig (6.9 kPa).

2.7 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   f. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   d. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.
2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils

(0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

C. Install fittings for changes in direction and branch connections.

D. Install pressure gage 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 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
   a. Exception: Tubing passing through partitions or walls does not require striker barriers.
5. Prohibited Locations:
   a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

W. 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."

X. 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."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing.

B. 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.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    c. Topcoat: Exterior alkyd enamel (flat).
    d. Color: Gray or safety yellow where required.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (flat).
    d. Color: Gray or safety yellow where required.
2. Alkyd System: MPI INT 5.1E.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd (flat).
    d. Color: Gray or safety yellow where required.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 DEMONSTRATION

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

3.13 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

C. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 kPa) AND LESS THAN 5 PSIG (34.5 kPa)

A. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

C. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:

1. One-piece, bronze ball valve with bronze trim.

B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:

1. One-piece, bronze ball valve with bronze trim.

D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

E. Valves in branch piping for single appliance shall be the following:

1. One-piece, bronze ball valve with bronze trim.

END OF SECTION 22 20 00

SECTION 22 34 00 - 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 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 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. LEED Submittal:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

C. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

D. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of commercial, gas-fired domestic-water heater, from manufacturer.

F. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

G. Source quality-control reports.

H. Field quality-control reports.

I. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

J. Warranty: Sample of special warranty.

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. ASHRAE/IESNA 90.1 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.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 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. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
      1) Storage Tank: Five years.
      2) Controls and Other Components: Two years.
   b. 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
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. AERCO International, Inc.
   b. Ajax Boiler Inc.
   c. American Water Heaters.
   d. Bradford White Corporation.
   e. Heat Transfer Products, Inc.
   f. Lochinvar Corporation.
   g. PVI Industries, LLC.
   h. RBI Water Heaters; a Mestek company.
   i. Rheem Manufacturing Company.
   j. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   k. State Industries.
   l. Weben-Jarco, Inc.
3. Standard: ANSI Z21.10.3/CSA 4.3.
4. Description: Manufacturer's proprietary design to provide at least 95percent combustion efficiency at optimum operating conditions.
5. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.
   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 (DN 65) 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Lining: Glasscomplying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
6. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: 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, domestic-water heaters and natural-gasfuel.
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.

7. Draft Hood: Draft diverter, complying with ANSI Z21.12

B. Capacity and Characteristics:

1. Capacity: 220 gal..
2. Recovery: 796 gph at 70 deg F temperature rise & 619 gph at 90 deg F temperature rise
3. Temperature Setting: 12 deg F and 140 deg F.
4. Fuel Gas Input: 499,900 Btu/h .
5. Gas Pressure Regulator:
   a. Capacity: 500 cfh.
   b. Inlet Pressure: 4.8 – 14 inches water column.
   c. Gas Pressure Required at Burner: 4.8 – 14 inches water column.
6. Electrical Characteristics:
   a. Volts: 120
   b. Phase: Three.
   c. Hertz: 60.
   d. Full-Load Amperes: 0.2.
   e. Minimum Circuit Ampacity: 5A.
   f. Maximum Overcurrent Protection: 15A.
7. Minimum Vent Diameter: 4 inches .

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
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. AMTROL Inc.
   b. Flexcon Industries.
   c. Honeywell International Inc.
   d. Pentair Pump Group (The); Myers.
   e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   f. State Industries.
   g. Taco, Inc.
3. 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.
4. 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

5. Capacity and Characteristics:
a. Working-Pressure Rating: 150 psig (1035 kPa).
b. Capacity Acceptable: 7 gal. (26.5 L)minimum.
c. Air Precharge Pressure: 40-60 PSI.

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 (DN 20) 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 calibrated balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
2. Comply with requirements for balancing valves specified in Division 22 Section "Domestic Water Piping Specialties."

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig (3.5-kPa) pressure rating as required to match gas supply.

H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

I. 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.

J. 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.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

L. 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 (457 mm) above the floor.

M. 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 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 Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "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 Division 03 Section "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 (450-mm) 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. 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 Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. 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.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23 Section "Facility Natural-Gas Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. 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.

F. 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.

G. 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 Division 22 Section "Domestic Water Piping Specialties."

H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

I. 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 Division 22 Section "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

J. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Division 23 Section "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in Division 23 Section "Facility 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 Division 22 Section "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.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "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 commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 22 34 00

SECTION 22 40 00 - 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. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories, showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Fixture supports.
5. Shower receptors.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Commercial sinks.
10. Service sinks.
11. Service basins.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section "Drinking Fountains and Water Coolers."

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Slip-Resistant Bathing Surfaces: ASTM F 462.

4. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
5. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
8. Water-Closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Brass Waste Fittings: ASME A112.18.2.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.

3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures of unit shell.
   b. Faulty operation of controls, blowers, pumps, heaters, and timers.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period for Commercial Applications: One year from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings and cartridges: Equal to 10 percent of amount of each type and size installed.
2. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
4. Toilet Seats: Equal to 10 percent of amount of each type installed.
5. Dry Urinal Trap-Seal Cartridges: Equal to 200 percent of amount of each type installed, but no fewer than 12 of each type.
6. Dry Urinal Trap-Seal Liquid: Equal to 1 gal (3.8 L) for each urinal installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

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. American Standard Companies, Inc.
   b. Bradley Corp
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Elkay Manufacturing Co.

f. Just Manufacturing Company.
g. Kohler Co.
h. Moen, Inc.
i. Speakman Company.

2. Description: Single-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
   a. Body Material: Commercial, solid brass.
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
   d. Centers: 4 inches (102 mm).
   e. Mounting: Deck, exposed or concealed.
   f. Valve Handle(s): Lever.
   g. Inlet(s): NPS 3/8 (DN 10) tubing, plain end.
   h. Spout: Rigid type.
   i. Spout Outlet: Aerator.
   j. Operation: Compression, manual or sensor.
   k. Drain: Grid.

2.2 SINK FAUCETS

A. Sink Faucets:

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. American Standard Companies, Inc.
   b. Chicago Faucets.
   c. Delta Faucet Company.
   d. Elkay Manufacturing Co.
   e. Just Manufacturing Company.
   f. Kohler Co.
   g. Moen, Inc.
   h. Speakman Company.
2. Description: Kitchen faucet with spray, three-hole fixture, Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
   a. Body Material: Commercial, solid brass.
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
   d. Mixing Valve: Single control or Two-lever handle.
   e. Backflow Protection Device for Hose Outlet: Required.
   f. Centers: 4 inches (102 mm), Single hole.
   g. Mounting: Deck, Back/wall.
   h. Handle(s): Lever or Wrist blade, 4 inches (102 mm).
   i. Inlet(s): NPS 3/8 (DN 10) plain-end tubing. NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter.
   j. Spout Type: Swing, round tubular.
   k. Spout Outlet: Spray, Hose thread.
   l. Vacuum Breaker: Required.
   m. Operation: Compression, manual

n. Drain: Grid.

2.3 FLUSHOMETERS

A. Flushometers:

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. Delta Faucet Company.
   b. Sloan Valve Company.
   c. Zurn Plumbing Products Group; Commercial Brass Operation.
   d. Sloan Valve Company.
   e. TOTO USA, Inc.
2. Description: Flushometer for urinal, water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
   a. Internal Design: Diaphragm operation.
   b. Style: Exposed.
   c. Inlet Size: NPS 3/4 (DN 20), NPS 1 (DN 25).
   d. Trip Mechanism: Hard-wired, electric-sensor actuator, battery-operated sensor actuator.
   e. Consumption: 1.0 gal./flush (3.8 L/flush) 1.6 gal./flush (6.0 L/flush) as shown.
   f. Tailpiece Size: As required.

2.4 TOILET SEATS

A. Toilet Seats:

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. American Standard Companies, Inc.
   b. Church Seats.
   c. Eljer.
   d. Kohler Co.
   e. Olsonite Corp.
2. Description: Toilet seat for water-closet-type fixture.
   a. Material: Molded, solid plastic with antimicrobial agent.
   b. Configuration: Open front without cover.
   c. Size: Elongated.
   d. Hinge Type: CK, check.
   e. Class: Heavy-duty commercial.
   f. Color: White.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
b. TCI Products.
c. TRUEBRO, Inc.
d. 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.
   b. Or Equal
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.6 FIXTURE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

C. Water-Closet Supports:

1. Description: Combination carrier designed for accessible (or as required) mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

D. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

E. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

F. Sink Supports:

1. Description: Type II, sink carrier with hanger plate, bearing studs, and tie rod for sink-type fixture. Include steel uprights with feet.

2.7 WATER CLOSETS

A. Water Closets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. American Standard Companies, Inc.
   b. Eljer.
   c. Kohler Co.
   d. TOTO USA, Inc.
2. Description Accessible, wall, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   a. Supply: Chrome-plated brass or copper, as shown.
   b. Style: Flushometer valve.
      1) Bowl Type: Elongated with siphon-jet design.
      2) Design Consumption: 1.6 gal./flush (6 L/flush).
      3) Color: White.
   c. Flushometer: Automatic
   d. Toilet Seat: Open Front.
   e. Fixture Support: Water-closet support combination carrier.

2.8 URINALS

A. Urinals:

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. American Standard Companies, Inc.
   b. Eljer.
   c. Kohler Co.
   d. TOTO USA, Inc.
2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   a. Type: Siphon jet.
   b. Strainer or Trapway: Integral cast strainer with integral trap.
   c. Design Consumption: 1 gal./flush (3.8 L/flush).
   d. Color: White.
   e. Supply Spud Size: NPS 3/4 (DN 20)
   f. Outlet Size: NPS 1-1/2 (DN 40).
   g. Flushometer: Automatic.
   h. Fixture Support: Urinal chair carrier.

2.9 LAVATORIES

A. Lavatories:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    a. American Standard Companies, Inc.
    b. Bradley Corp
    c. Commercial Enameling Company.
    d. Eljer.
    e. Kohler Co.
4. Description: Accessible, vitreous-china fixture installed in accordance with ANSI-A-117.1 to facilitate use by the physically handicapped.
    a. Type: Ledge back.
    b. Size: 20 by 18 inches (508 by 457 mm) rectangular.
    c. Faucet Hole Punching: One hole.
    d. Faucet Hole Location: Top.
    e. Pedestal: Not required.
    f. Color: White.
    g. Faucet: Lavatory.
    h. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
    i. Drain: Grid.
    j. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated, cast-brass P-trap; NPS 1-1/2 (DN 40), 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
    k. Drain Piping: Brass P-trap; NPS 1-1/2 (DN 40), tubular waste to wall; and wall escutcheon.
    l. Protective Shielding Guard(s): Required
    m. Fixture Support: Lavatory.

2.10 COMMERCIAL SINKS

A. Commercial Sinks:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    a. American Standard Companies, Inc.
    b. Commercial Enameling Company.
    c. Edjer.
    d. Kohler Co.
4. Description: Multi-compartment, counter-mounting, stainless-steel commercial sink with backsplash.
    a. Overall Dimensions: See plans
    b. Metal Thickness: 0.050 inch (1.3 mm).
    c. Compartment:

1) Drain: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain.
a) Location: Centered in compartment.

d. Faucet(s): Sink.
1) Number Required: One.
2) Mounting: Deck.

e. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops or shutoff valves.

f. Drain Piping: NPS 2 (DN 50) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass copper pipe waste to wall; continuous waste; and wall escutcheon(s).

2.11 SERVICE SINKS

A. Service Sinks:

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. American Standard Companies, Inc.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Eljer.
d. Kohler Co.

2. Description: Trap-standard- and wall-mounting, enameled, cast-iron fixture with roll-rim back and rim guard on front and sides.
a. Size: 24 by 20 inches (610 by 510 mm).
b. Size:
c. Color: White.
d. Faucet: Sink.
e. Drain: Grid with 3” outlet.
f. Trap Standard: 3” enameled, cast iron with cleanout and floor flange.
g. Fixture Support: Sink Manufactured requirements

2.12 SERVICE BASINS

A. Service Basins:

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. Acorn Engineering Company.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Florestone Products Co., Inc.
d. Precast Terrazzo Enterprises, Inc.
e. Stern-Williams Co., Inc.

2. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard.
a. Shape: Square.
b. Size: 36 by 36 inches (915 by 915 mm) or a s shown.
c. Height: 6 inches (150 mm).
d. Tiling Flange: Not required.
e. Rim Guard: On all top surfaces.
f. Color: Not applicable.
g. Faucet: See plans.
h. Drain: Grid with NPS 3 (DN 80) outlet.

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 plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

N. Install toilet seats on water closets.

O. Install trap-seal liquid in dry urinals.

P. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

R. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

S. Install shower flow-control fittings with specified maximum flow rates in shower arms.

T. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

U. 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."

V. Set shower receptors and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

W. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

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SECTION 22 47 00 - DRINKING FOUNTAINS AND WATER COOLERS

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 drinking fountains and related components:

1. Drinking fountains.
2. Fixture supports.

1.3 DEFINITIONS

A. Accessible Drinking Fountain: Fixture that can be approached and used by people with disabilities.

B. Cast Polymer: Dense, cast-filled-polymer plastic.

C. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.

D. Fitting: Device that controls flow of water into or out of fixture.

E. Fixture: Drinking fountain or water cooler unless one is specifically indicated.

1.4 SUBMITTALS

A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For fixtures 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains:

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. Elkay Manufacturing Co.
   b. Filtrine Manufacturing Company; Drinking Water Division.
   c. Halsey Taylor.
   d. Haws Corporation.
   e. Murdock, Inc.
   f. Oasis Corporation.
   g. Stern-Williams Co., Inc.
   h. Sunroc Corp.
2. Description: Accessible, Style W, wall-mounting drinking fountain.
   a. Material: Stainless steel.
   b. Receptor Shape: Rounded front.
   c. Back Panel: Stainless-steel wall plate behind drinking fountain.
   d. Bubblers: One with adjustable stream regulator, located on deck.
   e. Control: Push button.
   f. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
   g. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
   h. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.

2.2 FIXTURE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Co.
2. MIFAB Manufacturing, Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

C. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.
2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

3.6 CLEANING

A. After completing fixture installation, 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.

END OF SECTION 22 47 00

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.

3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.
b. Others as approved by Engineer.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.
b. Others as approved by Engineer

C. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.
c. Others as approved by Engineer

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting".

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project. Refer to Division 03, “Cast-in-Place Concrete” for additional requirements.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 23 05 00

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 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: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

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SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS 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.

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 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 (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
3. Others as approved by Engineer.

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, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. 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 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, provide products by one of the following:

1. Presealed Systems.
2. Others as approved by Engineer.

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.

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 (34.5-MPa), 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 (25-mm) 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 (50 mm) 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 (6.4-mm) 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.

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 (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing.
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) 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.

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.

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 (DN 150): Cast-iron wall sleeves.

   b. Piping NPS 6 (DN 150) size> and Larger: Galvanized-steel-pipe sleeves <Insert.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17

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SECTION 23 05 18 - 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. 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 set screw 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 set screw fastener.

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 set screw fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange

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.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons :

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring cups..
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, 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 and set screw.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.

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.

END OF SECTION 23 05 18

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART – 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 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. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

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 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.

1.5 SUBMITTALS

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

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. Pipe stands.
4. Equipment supports.

C. 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: 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.

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. Carpenter & Paterson, Inc.
2. Clement Support Services.

3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.
10. Approved Equal

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) 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 (50 mm) 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.

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 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: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

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 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 Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

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 (DN 65) 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 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 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. PS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) 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 (40 mm)

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 (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), 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 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
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 (DN 100 to DN 900), 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 (DN 100 to DN 900), 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 (DN 65 to DN 900) 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 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), 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 (DN 50 to DN 1050) 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 (DN 50 to DN 600) 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 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. 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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

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.

L. 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.

M. 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 (32 mm).
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.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 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 Mechanical – Expansion Anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

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SECTION 23 05 48 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Freestanding spring isolators.
4. Elastomeric hangers.
5. Spring hangers.
6. Pipe riser resilient supports.
7. Resilient pipe guides.
8. Restraining braces and cables.
9. Steel and inertia, vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 90.
2. Building Classification Category: III.
3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Coordination Drawings: Show coordination of bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. 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:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.
2. Minimum Durometer of 40.
3. Basis of Design: Mason Industries Type W.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Minimum Static Deflection of 0.35".
4. Basis of Design: Mason Industries Type ND.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
7. Basis of Design: Mason industries Type SLF.

E. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

F. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
8. Basis of Design: Mason Industries Type 30N.

G. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

H. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be

removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

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:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and –tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation -control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

D. Spring Hangers shall be used for all piping in equipment rooms or adjacent to noise-sensitive areas.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m)] o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
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. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
3. Measure isolator restraint clearance.
4. Measure isolator deflection.
5. Verify snubber minimum clearances.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 01 Section "Demonstration And Training."

3.7 HVAC VIBRATION-CONTROL DEVICE SCHEDULE

A. Supported or Suspended Equipment: Refer to Drawing Plans.

END OF SECTION 23 05 48

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SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 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. Valve tags.
5. 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. 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 (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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 (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 cover full 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 (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) 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 (A4) 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.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).
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 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.5 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 HVAC terminal devices and similar roughing-in connections on end-use fixtures and units. List tagged valves in schedule.

B. Valve-Tag Application Schedule:

1. Valve-Tag Size and Shape: 1-1/2 inches (38mm), round.
2. Valve-Tag Color: Natural
3. Letter Color: Black

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

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SECTION 23 05 93 - 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.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.

3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. TAB Conference: Meet with Architect, Owner and Construction Manager on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:
   a. The Contract Documents examination report.
   b. The TAB plan.
   c. Coordination and cooperation of trades and subcontractors.
   d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect Owner and Construction Manager.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

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.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section

"Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units and verify that they are accessible and their controls are connected and functioning.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "Duct Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.
    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer via Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-

motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-
heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.
   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR 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.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 TOLERANCES

A. Set HVAC system's air flow rates

B. 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.

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly 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.

3.11 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.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.
5. 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.
   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 (mm), and bore.
   i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
   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 (mm), and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
3. Test Data (Indicated and Actual Values):
   a. Total air flow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Filter static-pressure differential in inches wg (Pa).
   f. Preheat-coil static-pressure differential in inches wg (Pa).
   g. Cooling-coil static-pressure differential in inches wg (Pa).
   h. Heating-coil static-pressure differential in inches wg (Pa).
   i. Outdoor airflow in cfm (L/s).
   j. Return airflow in cfm (L/s).
   k. Outdoor-air damper position.

l. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch (mm) o.c.
   f. Make and model number.
   g. Face area in sq. ft. (sq. m).
   h. Tube size in NPS (DN).
   i. Tube and fin materials.
   j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm (L/s).
   b. Average face velocity in fpm (m/s).
   c. Air pressure drop in inches wg (Pa).
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
   e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
   f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
   g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
   h. Refrigerant expansion valve and refrigerant types.
   i. Refrigerant suction pressure in psig (kPa).
   j. Refrigerant suction temperature in deg F (deg C).

G. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btu/h (kW).
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and rpm.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.
   m. Sheave make, size in inches (mm), and bore.
   n. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
2. Test Data (Indicated and Actual Values):
   a. Total air flow rate in cfm (L/s).
   b. Entering-air temperature in deg F (deg C).
   c. Leaving-air temperature in deg F (deg C).
   d. Air temperature differential in deg F (deg C).
   e. Entering-air static pressure in inches wg (Pa).
   f. Leaving-air static pressure in inches wg (Pa).

g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btu/h (kW).
i. High-fire fuel input in Btu/h (kW).
j. Manifold pressure in psig (kPa).
k. High-temperature-limit setting in deg F (deg C).
l. Operating set point in Btu/h (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h (kW).

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:
   a. System identification.
   b. Location.
   c. Coil identification.
   d. Capacity in Btu/h (kW).
   e. Number of stages.
   f. Connected volts, phase, and hertz.
   g. Rated amperage.
   h. Air flow rate in cfm (L/s).
   i. Face area in sq. ft. (sq. m).
   j. Minimum face velocity in fpm (m/s).
2. Test Data (Indicated and Actual Values):
   a. Heat output in Btu/h (kW).
   b. Air flow rate in cfm (L/s).
   c. Air velocity in fpm (m/s).
   d. Entering-air temperature in deg F (deg C).
   e. Leaving-air temperature in deg F (deg C).
   f. Voltage at each connection.
   g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches (mm), and bore.
   h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
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 (mm), and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Suction static pressure in inches wg (Pa).

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F (deg C).
   d. Duct static pressure in inches wg (Pa).
   e. Duct size in inches (mm).
   f. Duct area in sq. ft. (sq. m).
   g. Indicated air flow rate in cfm (L/s).
   h. Indicated velocity in fpm (m/s).
   i. Actual air flow rate in cfm (L/s).
   j. Actual average velocity in fpm (m/s).
   k. Barometric pressure in psig (Pa).

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:
   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm (L/s).
   b. Entering-air temperature in deg F (deg C).
   c. Leaving-air temperature in deg F (deg C).

L. Instrument Calibration Reports:

1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:
   a. Measure airflow of at least 10 percent of air outlets.
   b. Measure water flow of at least 5 percent of terminals.
   c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   d. Verify that balancing devices are marked with final balance position.
   e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
   1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect and Owner.
   2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect and Owner.
   3. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
   4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

   1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

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SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."
2. Division 23 Section "HVAC Piping Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and factory- applied jackets.

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

D. 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.

E. Field quality-control reports.

1.4 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.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. 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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. 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. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. 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.
2. Concealed Duct:
   a. Nominal density of 0.75 PCF.
   b. Thermal conductivity (k-value) of 0.29 BTU-in/hr x ft^2 x °F.
   c. Installed thermal resistance (R-value), for 2-in. thick insulation, of 6.0.
3. Exposed Duct:
   a. Nominal density of 1.0 PCF.
   b. Thermal conductivity (k-value) of 0.27 BTU-in/hr x ft^2 x °F.
   c. Installed thermal resistance (R-value), for 2-in. thick insulation, of 6.0.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, 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; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, 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; 30-80/30-90.
   b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

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; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

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-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK 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 (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II..

2.6 TAPES

A. 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: 2.5 inches.
3. Thickness: 9 mils.
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 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, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   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) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   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) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   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) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

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) AGM Industries, Inc.; RC-150.
   2) GEMCO; R-150.
   3) Midwest Fasteners, Inc.; WA-150.
   4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
   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) GEMCO.
      2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. C & F Wire.

2.8 CORNER ANGLES

A. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

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.

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 ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) 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 duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 Section "Penetration Firestopping"firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts (supply air and outdoor air) and plenums (intake and exhaust) with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. 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 (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.8 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 ductwork, 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 one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.

B. Items Not Insulated:

   1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   4. Flexible connectors.
   5. Vibration-control devices.

6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed and exposed, round, supply-air and outdoor-air duct shall be furnished with 2-in. internal insulation as specified in section 23 31 13 Metal Ducts.

B. Concealed and exposed, round, return-air duct shall not be insulated.

C. Concealed, round, exhaust-air duct between isolation dampers and penetration of building exterior shall be furnished with insulation same as for round supply air duct.

D. Concealed, rectangular, supply- and return- air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 0.75-lb/cu. ft. nominal density.

E. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 0.75-lb/cu. ft. nominal density.

F. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

G. Exposed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

H. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

I. Exposed, rectangular, exhaust-air duct shall not be insulated.

J. Exposed, outdoor-air plenum insulation shall be the following:

1. Rigid Glass Fiber Board: 2 inches and 0.75-lb/cu. ft. nominal density.

K. Exposed, exhaust-air plenum insulation shall be the following:

1. Rigid Glass Fiber Board: 2 inches and 0.75-lb/cu. ft. nominal density.

END OF SECTION 23 07 13

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. Exhaust fan.

B. Related Sections:

1. Division 23 Section "Duct Insulation."
2. Division 23 Section "HVAC Piping Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail removable insulation at equipment connections.
4. Detail application at linkages of control devices.
5. Detail field application for each equipment type.

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 (300 mm) long by NPS 2 (DN 50).
2. Sheet Form Insulation Materials: 12 inches (300 mm) square.
3. Sheet Jacket Materials: 12 inches (300 mm) 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.

D. Qualification Data: For qualified Installer.

E. 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.

F. Field quality-control reports.

1.4 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.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

C. Coordinate installation and testing of heat tracing.

1.7 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 "Breeching Insulation Schedule" and "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket. 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.

G. 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 (454 Deg C) 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.

3. Type II, 1200 Deg F (649 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. 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.; CrimpWrap.
    b. Johns Manville; MicroFlex.

c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. ASJ 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; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, 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; 30-80/30-90.
   b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, 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-30.
   b. Eagle Bridges - Marathon Industries; 501.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
   d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. 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; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

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-10.
   b. Eagle Bridges - Marathon Industries; 550.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. ASJ 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 (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

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.

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, 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 tank heads and tank side panels.

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 (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

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, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)diameter shank, length to suit depth of insulation indicated.
   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) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
   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) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
   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) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
   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) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
      2) GEMCO; Peel & Press.
      3) Midwest Fasteners, Inc.; Self Stick.
   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
   a. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.
   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. C & F Wire.

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 and equipment 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. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

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- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4inches (100 mm) 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.

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 (100 mm) 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. Manholes.
5. Handholes.
6. Cleanouts.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches (75 mm).
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. 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.

3.6 FINISHES

A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
   a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections: Inspect field-insulated equipment, 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 oneocation(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment that is not factory insulated.

END OF SECTION 23 07 16

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SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Heating hot-water piping, indoors.

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."
2. Division 23 Section "Duct Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

D. 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.

E. Field quality-control reports.

1.4 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 and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 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. 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 (454 deg C) 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 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ 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; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, 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; 30-80/30-90.
   b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

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; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

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-10.
   b. Eagle Bridges - Marathon Industries; 550.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. ASJ Flashing Sealants 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 (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, use sealants that 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.

2.6 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.

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 (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. 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 (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) 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, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. C & F Wire.

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.
3. 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. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 2 inches (50 mm)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.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. 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. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "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.
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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 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 (150 mm) 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 (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch (25-mm) 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.

3.8 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, 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.

3.9 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.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. NPS 1-1/2 (DN 37) and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch (37 mm) thick.
2. NPS 2 (DN 50) and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches (50 mm) thick.

B. Steam Supply and Return, 250 Deg F and Below:

1. NPS 3 (DN 75) and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inch (64 mm) thick.
2. NPS 4 (DN 100) and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 3 inches (75 mm) thick.

C. Steam Supply and Return, 350 Deg F and Below:

1. NPS 3/4 (DN 19) and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 3 inch (75 mm) thick.
2. NPS 1 (DN 25) to NPS 1-1/4 (DN 31): Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 4 inches (100 mm) thick.
3. NPS 1-1/2 (DN 37) and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 4-1/2 inches (113 mm) thick.

D. Steam Supply and Return, 350 Deg F and Above:

1. NPS 3/4 (DN 19) and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 4-1/2 inch (113 mm) thick.
2. NPS 1 (DN 25) and Above: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 5 inches (150 mm) thick.

E. Steam Supply and Return, 350 Deg F and Above:

1. NPS 1-1/2 (DN 37) and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) thick.
   b. Cellular Glass, 2 inches (50 mm) thick
2. NPS 2 (DN 50) and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches (50 mm) thick.

3.11 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.

END OF SECTION 23 07 19

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SECTION 23 09 00 – HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. An Energy Performance Contract recently installed by Day Automation Building Services, Inc., shall be the basis of design. The district requires a continuation of the existing EMS to be installed by this contractor. Contact: David Kincaid – Tel: 585-315-3007.

B. The entire Energy Management and Control System (EMCS) shall be comprised of a network of direct digital controllers communicating on a contiguous communication network. All information from the EMCS shall be available to local computers within the building via local Intranet and to remote computers or from multiple facilities via the Internet. The EMCS shall be capable of communicating to third party systems such as HVAC, lighting, energy metering, power management, security, access control and other building management related devices with open, interoperable communication capabilities.

C. All labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

D. The Orange, Rockland, Ulster County School District presently has an extensive Schneider Electric IA Series Energy Management System by Day Automation Inc., installed in all schools buildings as part of past capital projects as well as an existing performance contract. The intent of this project is to extend and interoperate (read/write) with the existing Schneider system. The energy management software will host the new and existing equipment being installed under this project to maintain integrity for centralized scheduling, trending, programming and alarming. PC Desktop icons that “link” to a separate EMS system are not acceptable. Any costs associated with connecting to the existing energy management system, including factory licensed software, programming, training etc., shall be part of the controls contractor’s bid. Third party EMS or integration software used to perform the integration/interoperation will not be acceptable. The contractor must demonstrate their ability to perform the integration to the existing energy management system prior to submittal acceptance and invoicing. Provide a list of at least three (3) sites where such integration has been performed within a 60 mile radius of the site. All new and existing systems being controlled will be shown via dynamic Web based graphics with all pertinent system alarms for proper operation and maintenance. The use of separate PC workstations, gateways, metalinks and additional software graphic packages to accomplish this integration will not be accepted.

E. Prospective bidders shall visit the School District Buildings to verify existing DDC controls equipment and Contractors ability to be compatible with these controls before bid. Contact the Schools Supt. of Buildings and Grounds for details. Contractor shall provide Web based graphics for controlled equipment. Contractor shall configure graphic display to meet Owner and Engineer requirements. The Temperature Controls Contractor (TCC) shall provide each of the following portions of the complete EMCS as a standalone system that can communicate with any other DDC system which is following the same protocol.

(a) Operator Workstation: Existing

F. All proposed controls contractors that intend on interoperating with the existing DDC system utilizing DDC controls other than those presently installed in the district, shall submit a Technical Proposal, complete with the diagrams, Specifications Compliance Reports, product information, and supporting documentation outlined below 2 weeks prior to bid. The technical proposal will be utilized to evaluate the methodology that will be used to implement the interoperation and integration of the new controls of this project into the existing district wide energy management system.. It will also be used as a basis for vendor qualification on for the project. Arrange the Technical Proposal in order of the specification article numbers.

Include the following in a complete Technical Proposal:

1. A list of local jobs (three minimum) of similar type and size the bidder has installed, utilizing the products proposed for this project, with owner's representatives' names and telephone numbers for reference. This list should directly reflect:
   i. projects that include direct integration to third party microprocessor controllers of the type specified within the scope where an integration and interoperation of BACnet controls has been successfully achieved between two different manufacturers' controls systems.
2. EMCS network wiring diagram showing interconnection of all panels, workstations, system printer(s) etc. A diagram describing system architecture for this project with product code numbers for workstation, network controllers, application specific controllers, transducers, sensors, communication network, etc.
3. Provide information on owner training provided as part of the bid package as well as additional opportunities and factory schools available with associated cost. Include details of operator HVAC Training System as specified herein.
4. Specification Compliance Report. The specification compliance report shall address every paragraph within this specification (230900), utilizing an outline format, as follows:
   a. Comply-bid package complies without exception;
   b . Exception – bid package meets the functional intent, but not the letter of the specification. For each paragraph that an exception is taken, identify all deviations from what is specified in the given paragraph and provide a description of what is excluded, what is included, and how the contractor intends to meet the functional intent;
   c. Does not comply – bid package cannot meet specified function and will not be provided.

   For all paragraphs indicates as "Comply" or Exception", provide and reference factory product documentation to substantiate compliance.6.
5. Statement that all products used on this project is of current manufactures and are readily available through multiple distribution channels. Products in "field testing" status are not acceptable.

1.2 SUBMITTAL

A. Eight copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation, and input/output point list of all connected points to the EMCS system shall be included with the submittal package.

B. Submittal shall also include a system schematic diagram depicting (as required) the Full User Interface (FUI) and Browser User Interface (BUI) computers / peripherals, Network Area Controllers (NAC), 3rd party controllers and the networking equipment required to make a complete and functional system.

C. Upon completion of the work, provide an electronic set of 'as-built' drawings, job documentation and application software on magnetic floppy disk media or compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Submittal data such as sequence of operation and cut sheets shall be provided in an Adobe Acrobat™ format.

Eight printed copies of the 'as-built' drawings shall be provided in addition to the documents on magnetic floppy disk media or compact disk.

1. Provide 2 hard copy back-up disks and CD-ROM or USB Drive backup of all software programs and configurations, as the system exists at final acceptance.
2. Deliver one set of back-up disks to the Owner's Representative for turnover to the school district.
3. Deliver one set of back-up disks and the CD-ROM to Engineer.
4. Upon closeout with the first year, send updated disks and CD-ROM to the above listed personnel.
5. Provide all revisions and/or upgrades made to the system software during the one-year guarantee warranty period, at no additional cost to the Owner.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 23 HVAC Contractor:

1. Provides taps and installation of wells in piping for control system sensors and flow measurement devices.
2. Installation of any control system dampers.
3. Installation of any control valves.

B. Division 26, Electrical:

1. Provides motor starters and disconnect switches (unless otherwise noted).
2. Provides power wiring and conduit (unless otherwise noted).
3. Provision, installation and wiring of smoke detectors (unless otherwise noted).

1.4 AGENCY AND CODE APPROVALS

A. All products of the EMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916 Energy Management Systems
2. ULC, UL Canadian Standards Association
3. FCC, Part 15, Subpart J, Class A Computing Devices

1.5 SOFTWARE LICENSE AGREEMENT

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

1.6 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.7 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.8 QUALITY ASSURANCE

A. The Manufacturer of the EMCS digital controllers shall provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing). Product literature provided by the EMCS digital controller manufacturer shall contain the ISO-9001 Certification Mark from the applicable registrar.

1.9 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1. EMS Energy Management System
2. NAC Network Area Controller – Also known as JACE
3. IDC Interoperable Digital Controller
4. FUI Full User Interface
5. BUI Browser User Interface

6. DDC Direct Digital Controls
7. LAN Local Area Network
8. WAN Wide Area Network
9. OOT Object Oriented Technology
10. PICS Product Interoperability Compliance Statement

PART 2 - MATERIALS

2.1 GENERAL

A. The Energy Management Control System (EMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface

software, portable operator terminals, printers, network devices and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall EMCS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate BACnet and Invensys Network 8000 technology communication protocols in one open, interoperable system.

B. The programming computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, to assure interoperability between all system components is required. For each BACnet device that does not have BACnet certification, the device supplier must provide an XIF file for the device. All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.

C. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database or proprietary user interface programs shall not be acceptable.

D. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Systems employing a “flat” single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.

2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be either a 10 or 100 Megabits/sec Ethernet network supporting, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), Browser User Interfaces (BUIs) and/or Full User Interfaces (FUIs).

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 10 Base-T, UTP-8 wire, category 5
3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

2.4 NETWORK ACCESS

A. Remote Access.

1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, and ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Owner agrees to pay monthly access charges for connection and ISP.
2. Where no Local Area Network exists, EMCS supplier shall provide the following:
   a. 8 Port Ethernet hub (3Com, or equal)
   b. Ethernet router (Cisco or equal)
3. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line or T1 Line. Owner agrees to pay monthly access charges for connection and ISP

2.5 NETWORK AREA CONTROLLER (NAC OR JACE)

A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control

devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of BACnet controller data
7. Network Management functions for all BACnet based devices

B. The Network Area Controller must provide the following hardware features as a minimum:

1. One Ethernet Port -10 / 100 Mbps
2. One RS-232 port
3. One BACnet Interface Port – 78KB FTT-10A
4. Battery Backup
5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
6. The NAC must be capable of operation over a temperature range of 0 to 55°C
7. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C
8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

E. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
   a. To alarm
   b. Return to normal
   c. To fault
4. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

F. Control equipment and network failures shall be treated as alarms and annunciated.

G. Alarms shall be annunciated in any of the following manners as defined by the user:

1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
   a. Day of week
   b. Time of day
   c. Recipient
3. Pagers via paging services that initiate a page on receipt of email message
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

H. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, accessway, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

I. Alarm actions may be initiated by user defined programmable objects created for that purpose.

J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

L. Provide a “query” feature to allow review of specific alarms by user-defined parameters.

M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.6 DATA COLLECTION AND STORAGE

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.
2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.

D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

E. All log data shall be available to the user in the following data formats:

1. HTML
2. XML
3. Plain Text

4. Comma or tab separated values

F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:

1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached it's user-defined capacity of data stores
4. Provide ability to clear logs once archived

2.7 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has

reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.8 DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.9 INTEROPERABLE DIGITAL CONTROLLER (IDC)

A. Controls shall be microprocessor based Interoperable BACnet™ (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable BACnet™ interoperability logo on each product delivered.

B. HVAC control shall be accomplished using BACnet™ based devices where the application has a BACnet profile defined. Where BACnet devices are not available for a particular application, devices based on BACnet shall be acceptable. For each BACnet device that does not have BACnet certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each BACnet controller defining the programming or setup of each device. All programming,

documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation shall be provided.

C. The BACnet network trunk shall be run to the nearest Network Area Controller (NAC). A maximum of 126 devices may occupy any one BACnet trunk and must be installed in buss architecture using the appropriate trunk termination device. All BACnet devices must be supplied using FTT-10A BACnet communications transceivers.

D. The Network Area Controller will provide all scheduling, alarming, trending, and network management for the BACnet based devices.

E. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All IDCs shall be fully application programmable and shall at all times maintain their BACnet certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

G. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.10 FULL USER INTERFACE SOFTWARE (USE EXISTING)

A. Operating System:

1. The FUI shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.

B. The FUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

C. Real-Time Displays. The FUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the FUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.

a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration. At a minimum, the FUI shall permit the operator to perform the following tasks, with proper password access:

1. Create, delete or modify control strategies.
2. Add/delete objects to the system.
3. Tune control loops through the adjustment of control loop parameters.
4. Enable or disable control strategies.
5. Generate hard copy records or control strategies on a printer.
6. Select points to be alarmable and define the alarm state.
7. Select points to be trended over a period of time and initiate the recording of values automatically.

E. On-line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. On-line Documentation. Provide a context sensitive, on-line documentation system to assist the operator in operation and trouble shooting of each integrated system. On-line help shall be

available for all applications and shall provide the relevant data for that particular monitoring screen. As a minimum, provide a link to the Sequence of Operation, input/output summary, and cut sheets in either Adobe Acrobat™ or HTML format.

G. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

H. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

I. Alarm Console

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of

the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.

2. When the Alarm Console is enabled, a separate alarm notification window will supercede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.11 BROWSER USER INTERFACE SOFTWARE (EXISTING)

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Full User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens developed for the FUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the FUI shall be supported by the Web browser interface.
   HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
3. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
4. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
5. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
   a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
      1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
      2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
c. View logs and charts
d. View and acknowledge alarms

6. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to a pre-defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
7. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.12 SYSTEM PROGRAMMING

A. The Full User Interface software (FUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the FUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using

a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays

is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current

value on a user display. Systems requiring separate software tools or processes to create applications and user interface display shall not be acceptable.

C. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy

diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values
to inputs and monitor the logic for diagnosing execution before it is applied to the system.

4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.13 OBJECT LIBRARIES

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

1. BACnet devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide BACnet manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the BACnet profile shall be supported. Information (type and function) regarding network variables not defined in the BACnet profile shall be provided by the device manufacturer.
2. For devices not conforming to the BACnet standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

2.14 BACNET NETWORK MANAGEMENT

A. The Full User Interface software (FUI) shall provide a complete set of integrated BACnet network management tools for working with BACnet networks. These tools shall manage a database for all BACnet devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between BACnet devices, known as "binding". Systems requiring the use of third party BACnet network management tools shall not be accepted.

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to “learn” an existing BACnet network, regardless of what network management tool(s) were used to install the existing network, so that existing BACnet devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system shall not be accepted.

2.15 OTHER CONTROL SYSTEM HARDWARE

A. Motorized Control Dampers: Coordinate with the other trades for the exact quantity, size and location of all dampers. Dampers shall be black enamel finish or galvanized, with nylon bearings. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide maximum and frame shall be of welded channel iron. Dampers with both dimensions less than 18 inches may have strap iron frames. Ruskin CD-46 or Equal

B. Control Damper: Coordinate with other trades for exact quantity, size and location of all dampers. Provide all dampers unless Two-position or proportional electric actuators shall be direct-mount type. All actuators shall be spring return type. Provide one actuator per damper minimum.

C. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller; provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator’s terminal described elsewhere in this specification.

D. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of ± 0.2ºC. Outside air sensors shall include an integral sun shield.

E. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

F. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All electrical devices within a control panel shall be factory wired. All external wiring shall be connected to terminal strips mounted within the panel. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of ‘as-built’ control drawings (relating to the controls within that panel) shall be furnished within each control panel.

2.16 INPUT DEVICES

A. System accuracy of sensed conditions shall be as follows:

1. +/- .5°F for space temperature in the 0-130°F range
2. +/- .5°F for duct temperatures in the 40-130°F range
3. +/- 1.0°F for outside air temperatures in the (-30)-230°F range
4. +/- 1.0°F for water temperatures in the 30-230°F range
5. +/- .1 inch for filter status differential over a 0-2 inch range

B. The system shall maintain the specified analog end-to-end accuracy throughout the warranty period from sensor to controller readout.

C. Packaging: Sensors (transducers) will be appropriately packaged for the location.

1. Architectural housing for space mounting.
2. Weatherproof/sunshield housing for outdoors.
3. Thermal well housing for water applications.
4. Protective housing for duct mounting.

D. Environmental Ratings: The sensor/transducer shall be selected to withstand ambient conditions where:

1. Moisture or condensation is a factor.
2. Vibration exists from ductwork, equipment, etc.
3. Reasonably expected transient conditions exist for temperatures, pressures, humidities, etc. outside the normal sensing range.

E. Temperature Sensors:

1. Temperature sensors will be by the use of thermistors (10K ohm at 77°F) or RTDs (PT100 curve).
2. Sensors in the return or discharge duct shall be of the single point type. Sensors in the mixed air will be of the average type.
3. Thermowells shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.
4. Room temperature sensors:
   a. Sensing element only

F. Digital Sensors:

1. All digital inputs will be provided by dry contacts. The contacts will be wired normally open or normally closed as required.
2. Motor status (pumps, fans, etc.) shall be determined by current-operated switch.

2.17 OUTPUT DEVICES

A. The use of multiplexers will not be accepted.

B. Relays, Contactors:

1. All digital outputs will be electrically isolated from the digital controller by interface relays.
2. Field relays shall have a minimum life of 1 million cycles without failure.
3. Contactors shall have a minimum life of ten thousand cycles without failure.

2.18 ACTUATORS

A. Standard manufacturer damper actuators, proportional or two-position as required, sized to properly operate device. Damper actuators shall be of the direct coupled type, Belimo or equal.

2.19 WIRING AND CONDUIT

A. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.

B. Conduit shall be installed in MER's and shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.

C. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.

D. Junction boxes shall be provided at all cable splices, equipment terminations, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.

E. Where the space above the ceiling is a supply or return air plenum, the wiring shall be installed open, without conduit. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire alarm system shall be in conduit.

2.20 ENCLOSURES

A. All controllers and field interface panels shall be mounted in new enclosures unless otherwise stated in this specification.

B. All outside mounted enclosures shall meet the NEMA-4 rating.

C. Wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

2.21 CO2 SENSORS AND CONTROLLERS

A. Specifications:

1. Supply Voltage: 24 VAC +/-20%, 50/60 Hz (half-wave rectifier); 16.5-40 VDC Max.
2. Power Consumption: 3VA for 24VAC, 3W for 24VDC (peak); <0.9W (average)
3. Sensing Technology/Sensing Method: Single beam infrared sensing technology (NDIR); Diffusion

4. Measurement Range Default: 0 to 2,000 ppm CO2 Output Signal: Out 1: 0-5 VDC or 0-10 VDC (Default) Out 2: 4-20 mA (500 Ohm Load Max.)
5. Fail Safe: Polarity protected
6. CO2 Accuracy: +/- 40 ppm +/- 3% of reading (@ 15-35°C; 20-70% RH and 101.3 kPa)
7. Pressure Dependence: + 1.6% reading per kPa (deviation from standard pressure 101.3 kPa)
8. Response Time: ≤ 2 minutes, diffusion
9. Warm Up Time: < 1 minute (@ full specs < 15 minutes)
10. Operating Temperature/Relative Humidity Range: 32 to 122°F (0 to 50oC)/0 to 95%, non-condensing
11. Sensor Coverage Area: 7,500 sq. ft. maximum
12. Life Expectancy: > 15 years (typical)
13. Product Dimensions (Room Mount): (H) 4.5” (W) 2.75” (D) 1.12”
14. Product Dimensions (Duct Mount): (H) 5.98” (W) 3.33” (D) 1.85”

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office (representative). The installing office shall have a minimum of five

years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the local exclusive factory authorized temperature control contracting field office (branch or representative).

B. Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

C. Drawings of temperature control systems are diagrammatic only and any apparatus not shown, such as relays, accessories, etc., but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Temperature Control sub-contractor in accordance with these specifications.

E. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Temperature Control sub-contractor.

F. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

Verify location of room temperature sensors and other exposed control sensors with plans and room details before installation. Locate occupant adjustable devices 54 inches above floor to centerline of housing. Coordinate with adjacent devices.

3.2 WIRING

A. All electrical control wiring and power wiring to the control panels shall be the responsibility of the EMCS contractor.

B. The electrical contractor (Div. 16) shall furnish all power wiring to electrical starters and motors.

C. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All EMCS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 16) unless otherwise allowed by the National Electrical Code or applicable local codes. EMCS plenum rated cable wiring is allowed above suspended ceilings and shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

D. The 120VAC power wiring to each control panel shall be on a dedicated circuit, with a separate breaker. Junction box covers will be marked to indicate that they are a part of the EMCS system. Power for any EMCS equipment that is controlling equipment that operates under emergency power shall be obtained from emergency power panels.

E. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.

F. Coordinate connection of HAND-OFF-AUTO selector switches to override automatic interlock controls when switch is in HAND position.

3.3 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the EMCS due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Temperature Control sub-contractor at no expense to the Owner

3.4 WARRANTY ACCESS

A. The Owner shall grant to the Temperature Control sub-contractor, reasonable access to the EMCS during the warranty period. The owner shall allow the contractor to access the EMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 ACCEPTANCE TESTING

A. Upon completion of the installation, the Temperature Control sub-contractor shall load all system software and start-up the system. The Temperature Control sub-contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

The Temperature Control sub-contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

B. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

C. System Acceptance: Satisfactory completion is when the Temperature Control sub-contractor has performed successfully all the required testing to show performance compliance with the requirements

of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR INSTRUCTION, TRAINING

A. General

1. Owner training shall be executed in three phases. The first phase shall be provided off site at a Local Training Center and will be scheduled at a time immediately preceding owner acceptance. The purpose of this training is to provide an introduction and an overview of the EMCS. Completion of this training shall be a condition of system acceptance and the commencement of the Warrantee Period. The second phase of training shall take place at the actual customer job

site and will at a minimum include a site-specific walk through and hands on site-specific instruction. The third phase of training shall be again provided off site at the Local Training Center as a follow-up and enrichment to the introductory and site-specific training. A proposed training agenda will be submitted to the engineer in writing, and approved by the engineer before training takes place. All and materials shall be supplied for three trainees to be selected by the owner.

B. Phase I – Training (This phase of training shall be a minimum of 8 hours) This training will give the operator with little or no experience with the EMCS an introduction to:

1. Building automation fundamentals
2. System architecture and functions
3. System access using FUI software and BUI software
4. Basic concepts for OOT programming
5. Editing parameters such as set points and schedules
6. Day to day system monitoring techniques

C. Phase II - On-Site Training (This phase of training shall be a minimum of 8 hours) Site personal and operators shall become familiar and proficient with:

1. Using As-Built documentation-Sequence of operation, control drawings, Input / Output summaries
2. Field sensor and actuator location and maintenance
3. Field controller location and maintenance
4. System architecture and functions as they pertain to the site
5. FUI and BUI hardware operation and maintenance
6. FUI and BUI software site specific capabilities

D. Phase III – Training (This phase of training shall be a minimum of 8 hours) Building operators will become qualified using hands-on labs for:

1. Monitoring and making changes to a preprogrammed EMCS
2. Understanding the PC and windows environment
3. Using the Browser tools to navigate BUI functions
4. Using graphic floor plans and equipment screens
5. Changing point values such as set points, schedules, and overrides
6. Retrieving trend reports and graphs
7. Acknowledging exceptions and alarms.

E. The training room shall be clean, well lit, well ventilated and isolated from noise (including HVAC noise) and other distractions. The Contractor shall arrange, via delamping, covering fixtures or by light switches, for there to be adequate contrast lighting to take notes and fend off drowsiness.

F. Instructor shall employ an LCD panel, video projector or other suitable device to project large images of the EMCS software and/or other training images.

G. Printed training materials shall be tailored to the task at hand and shall be well illustrated. Materials shall take students through the steps of learning the EMCS and its software and shall provide sample exercises for the trainees to perform on the computers.

H. Training must steer clear of jargon and other confusing terminology and focus instead on learning how to use the system. Specific jargon may be addressed after the trainees have demonstrated a basic understanding of system operation.

I. Training shall involve actual field-type equipment using a training demonstration package that simulates real-time temperatures, settings, alarms, etc. Training shall also spend substantial time observing the site's actual system, include point logs, graphics, and alarms. In addition, a brief field visit shall be included to familiarize trainees with the equipment installed at their site.

J. Training must include quizzes, tests, and exercises that compel trainees to demonstrate understanding of the system's most important concepts. These concepts shall include, but not be limited to, the elements of a monitoring checklist developed by the site.

END OF SECTION 23 09 00

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SECTION 23 09 13 - ENCLOSED CONTROLLERS

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 enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Reduced-voltage solid state.

B. Related Section:

1. Division 23 Section "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:
   a. Each installed unit's type and details.

b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

E. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently 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 NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

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 Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. Rockwell Automation, Inc.; Allen-Bradley brand.
   d. Siemens Energy & Automation, Inc.
   e. Square D; a brand of Schneider Electric.
2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
4. Surface mounting.
5. Red pilot light.

2.2 REDUCED-VOLTAGE MAGNETIC CONTROLLERS

A. General Requirements for Reduced-Voltage Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A; closed-transition; adjustable time delay on transition.

B. Reduced-Voltage Magnetic Controllers: Reduced voltage, electrically held.

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 Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. Rockwell Automation, Inc.; Allen-Bradley brand.
   d. Siemens Energy & Automation, Inc.
   e. Square D; a brand of Schneider Electric.
2. Configuration:
   a. Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
   b. Part-Winding Controller: Separate START and RUN contactors, field-selectable for 1/2- or 2/3-winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
   c. Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.
3. Contactor Coils: Pressure-encapsulated type.
   a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24-V ac; obtained from integral CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
6. Bimetallic Overload Relays:
   a. Inverse-time-current characteristic.

b. Class 10 tripping characteristic.
c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
d. Ambient compensated.
e. Automatic resetting.

7. External overload reset push button.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty type.
   a. Push Buttons: Recessed types; momentary.
   b. Pilot Lights: LED types; colors as indicated.
   c. Selector Switches: Rotary type.
2. Elapsed Time Meters: Heavy duty with digital readout in hours; resettable.

B. N.C./ N.O. auxiliary contact(s).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, 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 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 23 Section "Identification for HVAC Piping and Equipment."

1. Label each enclosure with engraved nameplate.
2. Label each enclosure-mounted control and pilot device.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Set the taps on reduced-voltage autotransformer controllers at 50 percent.

3.6 PROTECTION

A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 23 09 13

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SECTION 23 09 33 - VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.

B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. All VFDs installed on this project shall be from the same manufacturer.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronic Engineers (IEEE)
   a) Standard 519-1992, IEEE Guide for Harmonic Content and Control.
2. Underwriters laboratories
   a) UL508C
3. National Electrical Manufacturer's Association (NEMA)
   a) ICS 7.0, AC Adjustable Speed Drives
4. IEC 16800 Parts 1 and 2

B. Qualifications:

1. VFDs and options shall be UL listed as a complete assembly. VFDs that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs with requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fusing.
2. CE Mark – The VFD shall conform to the European Union Electro Magnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.
3. Acceptable Manufactures:
   a) ABB ACH 550 Series in NEMA 3R enclosures suitable for roof mounting.
   b) Alternate manufacturer's requests must be submitted in writing at least 10 working days prior to bid. Approval does not relieve supplier of specification requirements.
   c) VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable.

1.3 SUBMITTALS

A. Submittals shall include the following information:

1. Outline dimensions, conduit entry locations and weight.
2. Customer connection and power wiring diagrams.
3. Complete technical product description include a complete list of options provided. Any portions of the specifications not complied with must be clearly indicated or the supplier and contractor shall be liable to provide all components required to meet the specification.
4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
   a) The VFD manufacturer shall provide calculations; specific to the installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with the IEEE
   electrical system standard 519. All VFDs shall include a minimum of 5% equivalent impedance reactors, no exceptions.

PART 2 – PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

A. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, (NEMA rated enclosures are not acceptable) completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

1. Environmental operating conditions: $0 – 40^0$ C continuous. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing. All circuit boards shall have conformal coating.
2. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD.

B. All VFDs shall have the following features:

1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There

shall be four (4) separate, independent timer functions that have both weekday and weekend settings. Capacitor backup is not acceptable.

4. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
5. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
6. The VFD shall have 5% equivalent impedance internal reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% equivalent impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add an AC line reactor.
7. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% equivalent impedance internal reactors.
8. The VFD shall provide a programmable proof of flow Form-C relay output (broken belt / broken coupling). The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

C. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter
   supplied by others. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network.
3. Two (2) programmable analog inputs shall accept current or voltage signals.
4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
5. Six (6) programmable digital inputs.
6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
7. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows motor operation. Two separate safety interlock inputs shall be provided.

When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.

8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
11. The VFD shall include password protection against parameter changes.

D. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (LED and alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words.

E. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

Output Frequency
Motor Speed (RPM, %, or Engineering units)
Motor Current
Drive Temperature
DC Bus Voltage
Output Voltage

F. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed or operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback . The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlock, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

G. Serial Communications

1. The VFD shall have an RS-485 port as standard. The standard protocols shall be LON. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and
2. multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BACnet). Use of non-certified protocols is not allowed.
3. The
4. BACnet connection shall be an RS485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the
5. BACnet Testing Labs and be Listed. The
6. BACnet interface shall conform to the LON standard device type of an Applications Specific Controller. The interface shall support all defined by the LON standard profile including, but not limited to:
   a. Data Sharing – Read Property – B.
   b. Data Sharing – Write Property – B.

c. Device Management – Dynamic Device Binding (Who-Is; I-AM).
d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
e. Device Management – Communication Control – B.

7. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

H. EMI / RFI filters. All VFDs shall include EMI/RFI filters. The VFD shall comply with standard EN 61800-3 for the First Environment, restricted level with up to 100' of motor cables. No Exceptions. Certified test lab test reports shall be provided with the submittals.

I. All VFDs through 60HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not be damaged by this condition.

J. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.

1. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted
2. Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.

K. The following operators shall be provided:
a. Bypass Hand-Off-Auto
b. Drive mode selector and light
c. Bypass mode selector and light
d. Bypass fault reset
e. Bypass LDC display, 2 lines, for programming and status / fault / warning indications

1. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in Bypass mode are not acceptable.
2. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage as a minimum. The system shall incorporate circuitry that

will allow the drive or bypass contactor to remain “sealed in” over this voltage tolerance at a minimum.

3. The Bypass system shall NOT depend on the VFD for bypass operation. The bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.
4. Serial communications – the bypass and VFD shall be capable of being monitored and or controlled via serial communications. Provide communications protocols for
5. BACnet in the bypass controller.
6.
7. BACnet Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relays output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be transmitted over the serial communications bus – keypad “Hand” or “Auto” selected, and bypass selected. The DDC system shall also be able to monitor if the motor is running under load in both VFD and bypass (proof of flow) in the VFD mode over serial communications or Form-C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

8. Run permissive circuit - there shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.
9. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor operation shall be indicated on the Bypass LCD display as well as over the serial communications protocol.
10. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.
11. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.
10. There shall be an adjustable motor current sensing circuit for the bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.
11. The bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs.
12. The relay outputs from the bypass shall programmable for any of the following indications.
    a. System started

b. System running
c. Bypass override enabled
d. Drive fault
e. Bypass fault
f. Bypass H-O-A position
g. Motor proof of flow (broken belt)
h. Overload
i. Bypass selected
j. Bypass run
k. System started (damper opening)
l. Bypass alarm
m. Over temperature

13. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.
14. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
15. The user shall be able to select the text to be displayed on the keypad when the safety opens. Example text display indications include “Firestat”, “Freezestat”, “Over pressure” and “Low pressure”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
16. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the requirements of the VFD manufacturer’s installation manual.

3.2 START-UP

A. Certified factory start-up shall be provided for each drive by a factory certified service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.

B. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

3.4 WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION 23 09 33

SECTION 23 09 93 - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sequence of operation:

1. Rooftop Units (RTU).
2. Dedicated Outside Air System (DOAS)
3. Fan Coil Unit
4. Exhaust Fans (Kitchen exhaust, etc.)
5. Makeup air Unit (MAU).
6. Heat Pump Units (HPCC).

1.2 RELATED DOCUMENTS

A. General Provisions of Contract, including General Conditions, Supplementary Conditions, Prevailing Hourly Wage Rates and Prevailing Hourly Supplements as updated by the NYS Department of Labor, General Requirements, and other related sections of the Specifications govern this section.

B. Refer to Drawings for additional information, Schematic and Sequence of Operation to be coordinated with Sequence herein.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate mechanical system controlled and control system components.

1. Label with settings, adjustable range of control and limits. Include written description of control sequence.
2. Include flow diagrams for each control system, graphically depicting control logic.
3. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.5 SUBMITTALS AT PROJECT CLOSEOUT – DIVISION 1

A. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 GRAPHIC DISPLAY

A. Provide graphic displays for each system, (DOAS, RTU, KX, EF, IX, etc.) as applicable to the system type. All setpoints shall be capable of being adjusted by the user. The controls contractor shall provide all necessary controllers, sensors, etc.

1. System graphic.
2. System on/off indication.
3. System day/night mode.
4. Outside air temperature indication.
5. Room temperature indication.
6. Operation mode for all exhaust fans, fan coil unit, MAU, RTU and HPCC, etc..

3.2 EXHAUST FANS

GENERAL: Local switch as herein specified shall be furnished by Division 23 and installed by Division 26.

Contacts for signaling the EMS shall be furnished and installed by this contractor under this Division 23 as well as fans operating with other fans or system as specified herein.

New Kitchen Hood Exhaust Fans for general spaces: These fans shall be provided with DDC compatible variable frequency drives. Start/stop shall be in accordance with the occupancy schedule for the area served as determined by the time-of-day schedule. In the unoccupied mode, the fan shall be off and its respective motorized exhaust air damper shall be closed. When a supply fan serving the respective space is on (i.e. Makeup Air Units or AC units) the respective exhaust fan shall start and run at a pre-determined minimum speed. A software program resident in the DDC Network Area Controller shall determine the output signal to the variable frequency drive based on hardwired feedback from the units controllers as the position of the outside air dampers from each unit serving the same space as the exhaust fan, modulates via their respective CO2 sensors. As the outside air dampers modulates towards the full open position, (for free cooling, economizer cycle) the speed of the exhaust fan shall increase proportionally to the position of the dampers.

A. New building and toilet exhaust fans shall operate by time schedule by the DDC system operator. Schedule to be determined by the district.

B. Toilet exhaust shall operate by occupancy and time schedule. Schedules to be determined by the district.

3.3 FAN COIL UNITS – HEATING MODE

A. The outside air intake damper, shall be controlled via their associated DOAS own separate and unique binary outputs. It is not permissible to control multiple end devices from a common binary output. All fan coil units shall be controlled to ASHRAE cycle II requirements as modified herein. Supply fan status for all fan coil units shall be via current sensing relay. Other status devices such as filters shall be provided. The front end of the EMS will interpret the signal as fan

status and filter status.

B. When the fan coil units are off, upon loss of power, the outside air damper shall be closed.

C. The fan coil units shall be started either automatically, along with associated DOAS units, based on day schedules used by the school, or remotely through a command at any of the operator workstations or automatically when the space is unoccupied and the space temperature is below the night heating setpoint.

D. There shall be three (3) adjustable, space temperature setpoints as follows:

- Heating Night – The system is off unless the space temperature goes below this setpoint.
- Unoccupied Heating Day – Utilized when the space is vacant and heating is required.
- Occupied Heating Day – Utilized when the space is occupied and heating is required.

E. During the day modes, the occupied/unoccupied status shall be determined from the owners work station schedule.

F. Night Operation: Whenever the space temperature falls below the night heating setpoint, the unit ventilator shall cycle to maintain desired temperature. During this mode, the return air damper shall open, the outside air damper shall remain closed and the exhaust fan serving the space shall remain off.

G. Whenever the unit ventilator is started in other than the night mode, the outside air damper shall open to its adjustable minimum position. A room thermostat, through its respective UNT Controller shall modulate the face/bypass damper to maintain desired room temperature based on the working setpoint. As the space temperature rises above the working setpoint, the UNT Controller shall gradually modulate the coil damper towards the full bypass position. If the room temperature continues to rise and the face/bypass damper is in the full bypass position, the 2 position control valve on the heating coil shall close and the outside air damper shall be modulated towards the full open position to maintain desired room temperature.

H. A low limit temperature sensor, through the DDC UNT controller, shall override the room sensor and prevent the unit discharge temperature from falling below a predetermined limit. A low temperature warning alarm shall be initiated at all operator workstations if the discharge temperature falls to within 5^0F of the setpoint of the electric low temperature protection thermostat.

I. An electric, factory installed, low temperature protection sensor shall stop the unit, keep the compressor operating, close the O.A. damper and initiate an alarm if it senses a temperature across any 6” increment of its sensor less than setpoint (39^0F, adjustable).

J. Relief Air Exhaust Fans: When FCU outside air dampers are open, associated exhaust

or DOAS unit shall exhaust or relief outside air accordingly as herein specified (under exhaust fans) by its’ associated variable frequency drive.

3.4 FAN COIL UNITS– COOLING MODE

A. The outside air intake damper, and air cooled condenser shall be controlled via their own separate and unique binary outputs. It is not permissible to control multiple end devices from a common binary output. All fan coil units shall be controlled to ASHRAE cycle II requirements as

modified herein. Supply fan status for all fan coil units shall be via current sensing relay. Other status devices such as filters shall be provided. The front end of the EMS will interpret the signal as fan status and filter status.

B. When the unit is off, upon loss of power, the outside air damper shall be closed.

C. The fan coil unit shall be started either automatically based on day schedules used by the school, or remotely through a command at any of the operator workstations or automatically when the space is unoccupied and the space temperature is above the night cooling setpoint.

D. There shall be three (3) adjustable, space temperature setpoints as follows:

- Cooling Night – The system is off unless the space temperature goes below this setpoint.
- Unoccupied Cooling Day – Utilized when the space is vacant and heating is required.
- Occupied Cooling Day – Utilized when the space is occupied and heating is required.

E. During the day modes, the occupied/unoccupied status shall be determined from the owners work station schedule.

F. Night Operation: Whenever the space temperature rises above the night cooling setpoint, the unit ventilator shall cycle to maintain desired temperature. During this mode, the return air damper shall open, the outside air damper shall remain closed and the exhaust fan serving the space shall remain off.

G. Whenever the unit is started in other than the night mode, the outside air damper shall open to its adjustable minimum position. A room thermostat, through its respective UNT Controller shall modulate the face/bypass damper to maintain desired room temperature based on the working setpoint. As the space temperature falls below the working setpoint, the UNT Controller shall gradually modulate the coil damper towards the full bypass position. If the room temperature continues to fall and the face/bypass damper is in the full bypass position, the air cooled condenser relay on the cooling coil shall open and the outside air damper shall be modulated towards the full open position to maintain desired room temperature.

H. An upper limit temperature sensor, through the DDC UNT controller, shall override the room sensor and prevent the unit discharge temperature from rising above a predetermined limit. An upper limit temperature warning alarm shall be initiated at all operator workstations if the discharge temperature rises to within 5^0F of the setpoint of the electric upper limit temperature protection thermostat.

I. An electric, factory installed, upper limit temperature protection sensor, shall stop the fan coil unit, , keep the air cooled condensing unit circulating refrigerant to the DX coil, close the O.A. damper and initiate an alarm if it senses a temperature across any 6” increment of its sensor greater than setpoint (65^0F, adjustable).

J. Relief Air Exhaust Fans: When UV outside air dampers are open, associated exhaust fans shall exhaust or relief outside air accordingly as herein specified (under exhaust fans) by its’ associated variable frequency drive. (James Evans)

3.5 CO2-DEMAND CONTROL VENTILATION

1. Sequence of Operation shall include the following:

A. Ventilation to handle the non-occupant related contaminants.

B. Pre-occupancy purge.

C. Post-occupancy flush.

D. Outdoor air damper positioning during occupied periods.

2. The CO_2 controller shall include in the sequence a provision for minimum ventilation rate 24 hours per day, 365 days a year a purge of the space prior to occupancy. Preoccupancy purge shall consist of a 30-minute fan(s) operation with outside air damper open to maximum occupant load position.

3. Post Occupancy Flush: Unit must run with outside air damper open after the occupied times to reduce CO_2 concentrations in the space to outside air levels, prior to shutting down.

4. Provide provision for a proportional-integral or a proportional-integral-derivative CO_2 controller. Controller/sensor shall be self-calibrating. See Section 15970 for CO_2 system and controllers.

5. Provide provision for measuring outside air CO_2.

6. The outside air damper (OAD) must start to modulate open beyond the minimum setting starting at an interior concentration of not greater than 100 ppm over that of the outside air and be open for full occupancy when CO_2 concentrations reach upper limit (ppm) over that of the outside air. Upper limit of CO_2 must be provided. Limit must be based upon metabolic rate of activities in area and volumetric flow rate required by code for area served.

7. Provide provision for economizer override of CO_2 control when conditions permit free cooling of building.

8. Contractor shall include extended commissioning (1 year) to check calibration of CO_2 sensor, monitor/test CO_2 levels to ensure target per person ventilation rates are met and maintained.

9. Record keeping: Space and outside air CO_2 conditions must be recorded at not greater than 15-minute intervals. Records of CO_2 concentrations must be kept for a minimum of three years. These records must be maintained in the custodian's office for review by the New York State Education Department.

3.6 NEW AIR HANDLING UNITS

A. Operation shall be controlled through EMS scheduling. When operation, modulate the normally-closed outside air damper and normally-open return air damper to maintain ventilation flow rates as measured in the outside air duct at the scheduled minimums.

B. Minimum Ventilation: Minimum outside airflow rates (as scheduled on dwgs.) shall be controlled through EMS and as through system operator adjustment.

C. Economizer Cooling: When outside air temperature is below 65 degrees F (adjustable), the outside air and return air dampers shall be modulated to maintain the discharge air setpoint temperatures. Discharge Air Setpoint Control: Discharge air temperature shall be reset according to space temperature sensors. As the average of the space temperature sensors increases to above 72 degrees F (adjustable), the normally closed outside air damper shall modulate open

from min O.A. to max O.A. As space temperature decreases, the outside air damper shall modulate from 100% to the minimum position.

D. Relief Fan Operation For All Units: When the O.A damper reaches their minimum scheduled open position as determined by an adjustable end switch, then the relief fan shall start.

E. Relief Fan Operation: When the O.A. damper reaches its minimum scheduled open position as determined by an adjustable end switch, then the relief fan shall start and modulate airflow by its respective damper.

F. Smoke Detection: When the presence of smoke is detected at a duct smoke detector provided under the E contract, then the fan starter circuit shall be de-energized and the EMS shall be alarmed.

G. Filter Alarm: A differential pressure sensor across the filters shall alarm the EMS when filter pressure drop exceeds 0.5 inches w.g. (adjustable). The speed of the VFD drive shall increase to maintain total design airflow.

H. Fan Alarm: A current sensor installed on the fan motor shall alarm the EMS when the motor current drops below or exceeds the field adjustable setpoints.

I. Cooling: When cooling (if so indicated) is indexed to ON,

J. Compressor shall modulate to maintain room sensor setpoint.

K. When the supply fan is indexed to ON during occupied mode, the outside air and relief air dampers shall open to their minimum position and the discharge air algorithms shall be activated. A discharge air temperature sensor, reset by its respective space temperature sensor, shall, through its respective DDC or application specific controller, modulate the heating coil in sequence with the variable frequency drive (for AHU-1, 2, 3, 4), outside, return and relief air dampers to maintain desired space temperature. During unoccupied mode, the outside air damper shall close and the return air damper shall open for 100% recirculation and the VFD for AHU-1, 2, 3& 4 shall reduce the fan speed as required to maintain setback temperature.

N. High occupied peak demand operation for AHU-1, 2, 3 &4: During early morning warm-up, the O.A. damper shall be closed and the system shall re-circulate 100%. As scheduled, via the OWS, such as predetermined lunch time schedule or assembly functions, the O.A. damper shall open, the relief/exhaust air damper shall open 100%, the return air damper shall close, and the heating control valve shall modulate to maintain set point occupied temperature. The VFD shall be at full speed during high occupied peak demand.

3.7 FAN SHUT-DOWN

A. When the fire alarm system goes into an alarmed mode auxiliary contact from the fire alarm system shall de-energize causing all units over 1,000 cfm such as air handlers, rooftop AC units, classroom unit s, and exhaust fans to shutdown. All systems shall be capable of reset through the fire alarms and/or the EMS. This contractor or sub controls contractor shall provide necessary relays for this operation

3.8 GENERAL

A. Refer to Control Drawing H-700 Series for additional controls requirements and information.

END OF SECTION 23 09 93

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SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Filter dryers.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot (1:50).
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.

5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 275 deg F (135 deg C).

B. 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 (3450 kPa).

C. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig (2760 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).
8. Manual operator.

D. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F (4.4 deg C).
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig (4820 kPa).

E. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig (3450 kPa).
5. Maximum Operating Temperature: 275 deg F (135 deg C).

F. 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 (3450 kPa).
6. Maximum Operating Temperature: 275 deg F (135 deg C).

G. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

2.3 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines: Copper, Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazedjoints.

C. Hot-Gas and Liquid Lines:

1. NPS 5/8 (DN 18) and Smaller: Copper, Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
2. NPS 1-1/4 (DN 32) and Smaller: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony 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. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

D. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

E. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

F. 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.

G. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or

panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal suction lines with a uniform slope downward to compressor.
2. Install traps and double risers to entrain oil in vertical runs.
3. Liquid lines may be installed level.

P. 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.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

S. 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."

T. 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."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. 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.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). 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 (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

SECTION 23 31 13 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Double-wall round ducts and fittings.
4. Sheet metal materials.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

D. 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, structural steel, mechanical equipment, 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. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

E. Field quality-control reports

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lindab Inc.
   b. McGill AirFlow LLC.
   c. SEMCO Incorporated.

B. GENERAL

1. All round supply, return and exhaust ductwork shall be by the manufacturer. The duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct which, when installed according to the manufacturer’s instructions, will seal the duct joints without the use of duct sealer.
2. The contractor may, with the approval of the engineer, convert select rectangular duct-work to round provided that the project space limitations are properly addressed and that the overall system design static pressure not be exceeded.

C. MATERIALS

1. Unless otherwise noted, all duct and fittings shall be G-90 galvanized steel in accordance with ASTM A-653 and A-924.

2. When specified on contract documents, stainless steel type 304 or type 316 in accordance with ASTM A-240 shall be provided.

D. CONSTRUCTION

1. Unless otherwise noted, all duct and fittings shall be constructed per SMACNA's Duct Construction Standards (+10 in W.G.) shown in the following table:

Diameter (inches)	Galvanized Fittings
3-14	24
16-26	22
28-36	20
38-50	20

2. FITTINGS:
   a. All fitting ends shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet all of the performance criteria set forth in the manufacturer's literature. Gasket shall be classified by an internationally recognized laboratory authority to conform to ASTM E84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.
   b. All fitting ends shall be calibrated to manufacturer's published dimensional tolerance standard and associated spiral duct.
   c. All fitting ends from 3" to 24" Dia. shall have rolled over edges for added strength and rigidity.
   d. All elbows from 3" to 12" Dia. Shall be 2 piece die stamped and continuously stitch welded. All elbows 14" Dia. And larger shall be standing seam gorelock construction and internally sealed.
   e. The radius of all 90° and 45° elbows shall be 1.5 times the elbow diameter, unless otherwise noted on the contract documents to be 1.0 times the elbow diameter. The radius of all 15°, 30° and 60° elbows shall be 1.0 times the elbow diameter.
   f. All fittings that are of either spot-welded or button punched construction shall be internally sealed. When contract documents require divided flow fittings, only full body fittings will be accepted. The use of duct taps is unacceptable except for retrofit installations.
   g. All volume dampers shall be by the spiral duct manufacturer. Damper shall be fitting sized to slip into spiral duct. Damper shall have the following features:
      (1) Locking quadrant with blade position indicator
      (2) 2" sheet metal insulation stand-off
      (3) Integral shaft/blade assembly
      (4) Shaft mounted, load bearing bushings
      (5) Gasketed shaft penetrations to minimize leakage

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Factory 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: White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

D. 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.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 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: 3 inches (76 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), 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. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and 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 (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure and seal classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts 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 A.
4. Outdoor, Return-Air Ducts: Seal Class A.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Exhaust Ducts: Seal Class B.
7. Unconditioned Space, Return-Air Ducts: Seal Class B.
8. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower:
   a. Exposed: Seal Class A.
   b. Concealed: Seal Class C.
9. Conditioned Space, Exhaust Ducts: Seal Class B.
10. Conditioned Space, Return-Air Ducts:
    a. Exposed: Seal Class B.
    b. Concealed: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct systems 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 Division 23 Section "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Energy recovery wheels.
6. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
7. Supply-air ducts, dampers, actuators, and turning vanes.
8. 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.

3.9 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. All Systems:
   a. Pressure Class: Positive 2-inch wg (500 Pa).

C. Return Ducts:

1. All Systems:
   a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

D. Exhaust Ducts:

1. General Exhaust Ductwork:
   a. Pressure Class: Negative 2-inch wg (500 Pa).

E. Outdoor-Air Ducts:

1. All Systems :
   a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts Galvanized steel or carbon steel coated with zinc-chromate primer.

G. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 2 inches (51 mm) thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "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 (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
   c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION – 23 33 00 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. Manual volume dampers.
3. Fire dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. LEED Submittal:

1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."

C. 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. 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.
d. Wiring Diagrams: For power, signal, and control wiring.

D. 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.

E. Source quality-control reports.

F. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

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 AMCA 500-D testing for damper rating.

1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for ducts and finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Ruskin Company.
5. SEMCO Incorporated.
6. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 2-inch wg (0.25 kPa).

E. Frame: 0.063-inch- (1.6-mm-) thick extruded aluminum with welded corners..

F. Blades: Multiple single-piece blades, maximum 6-inch (150-mm) width, 0.050-inch- (1.2-mm-) thick aluminum sheet with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Stainless steel.
2. Diameter: 0.20 inch (5 mm).

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: 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 (1.0-mm) minimum.
   b. Sleeve Length: 6 inches (152 mm) minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Aluminum.

8. Screen Type: Insect.
9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. Air Balance Inc.; a division of Mestek, Inc.
   b. McGill AirFlow LLC.
   c. METALAIRE, Inc.
   d. Nailor Industries Inc.
   e. Ruskin Company.
   f. Trox USA Inc.
   g. Vent Products Company, Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. McGill AirFlow LLC.
   c. METALAIRE, Inc.
   d. Nailor Industries Inc.
   e. Ruskin Company.
   f. Trox USA Inc.
   g. Vent Products Company, Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.

4. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) 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- (2.5-mm-) thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
6. Blade Axles: Nonferrous metal.
7. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) 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. Jackshaft:

1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. NCA Manufacturing, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) 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- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

2.5 FLANGE CONNECTORS

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. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

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 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

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 Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - 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-inch (25-by-25-mm) butt 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 (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches.

d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.8 DUCT ACCESS PANEL 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. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch (1.1-mm) stainless steel.

D. Fasteners: Stainless 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 (1093 deg C).

F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.9 FLEXIBLE CONNECTORS

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches (146 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. 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. (810 g/sq. m).

2. Minimum Tensile Strength: 500 lbf/inch (88 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd. (542 g/sq. m).
2. Tensile Strength: 285 lbf/inch (50 N/mm) in the warp and 185 lbf/inch (32 N/mm) in the filling.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).
2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp and 340 lbf/inch (60 N/mm) in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

H. 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 (6-mm) movement at start and stop.

2.10 FLEXIBLE DUCTS

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. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and ployester film without adhesive (mechanically locked) supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film..

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 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. 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.

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 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 (15-m) spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect diffusers or boots to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

Q. Install duct test holes where required for testing and balancing purposes.

R. 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 (6-mm) movement during start and stop of fans.

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 23 33 00

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. Centrifugal wall ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

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 with sound attenuation.
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:

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: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Aerovent; a division of Twin City Fan Companies, Ltd.
2. Carnes Company.
3. Greenheck Fan Corporation.

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.
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 fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 18 inches (450 mm).
3. Sound Curb: Curb with sound-absorbing insulation.
4. Metal Liner: Galvanized steel.

G. Capacities and Characteristics:

1. Refer to Drawings and Schedule Sheet

2.2 CENTRIFUGAL WALL VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Aerovent; a division of Twin City Fan Companies, Ltd.
2. Carnes Company.
3. Greenheck Fan Corporation.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: 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 fan housing, factory wired through internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) 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.
6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Capacities and Characteristics:

1. Refer to Drawings and Schedule Sheet.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment." All motors shall be inverter capable premium efficiency rated.

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. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using Vibration- and seismic-control devices specified in Division 23.

C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.

D. Install units with clearances for service and maintenance.

E. 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 Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

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. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.
2. Adjustable bar registers and grilles.
3. Fixed face registers and grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes.
   d. Hart & Cooley Inc.
   e. Krueger.
   f. METALAIRE, Inc.
   g. Nailor Industries Inc.
   h. Price Industries.
   i. Titus.
   j. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, color selected by Architect.
5. Face Size: As indicated on HVAC plans.
6. Face Style: As indicated on HVAC plans.
7. Mounting: As indicated on HVAC plans.
8. Pattern: As indicated on HVAC plans.
9. Dampers: Radial opposed blade.
10. Accessories:
    a. Equalizing grid.
    b. Plaster ring.
    c. Safety chain.
    d. Wire guard.
    e. Sectorizing baffles.
    f. Operating rod extension.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes
   d. Dayus Register & Grille Inc.
   e. Hart & Cooley Inc.
   f. Krueger.
   g. METALAIRE, Inc.

h. Nailor Industries Inc.
i. Price Industries.
j. Titus.
k. Tuttle & Bailey.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Horizontal.
7. Frame: 1-1/4 inches (32 mm).
8. Mounting Frame: Filter.
9. Mounting: Lay in or surface as indicated on HVAC plans.

B. Adjustable Bar Grille:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes.
   d. Dayus Register & Grille Inc.
   e. Hart & Cooley Inc.
   f. Krueger.
   g. METALAIRE, Inc.
   h. Nailor Industries Inc.
   i. Price Industries.
   j. Titus.
   k. Tuttle & Bailey.
2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Horizontal.
7. Frame: 1-1/4 inches (32 mm).
8. Mounting Frame: Filter.
9. Mounting: Lay in or surface as indicated on HVAC plans.

C. Fixed Face Register

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes.
   d. Dayus Register & Grille Inc.
   e. Hart & Cooley Inc.
   f. Krueger.
   g. Nailor Industries Inc.
   h. Price Industries.
   i. Titus.
   j. Tuttle & Bailey.
2. Material: Aluminum.

3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Perforated core.
5. Core Construction: Removable.
6. Frame: 1-1/4 inches (32 mm) wide.
7. Mounting Frame: Filter.
8. Mounting: Lay in or surface as indicated on HVAC plans.
9. Damper Type: Adjustable opposed blade.

D. Fixed Face Grille:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes.
   d. Dayus Register & Grille Inc.
   e. Hart & Cooley Inc.
   f. Krueger.
   g. Nailor Industries Inc.
   h. Price Industries.
   i. Titus.
   j. Tuttle & Bailey.
2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Perforated core.
5. Core Construction: Removable.
6. Frame: 1-1/4 inches (32 mm) wide.
7. Mounting Frame: Filter.
8. Mounting: Lay in or surface as indicated on HVAC plans.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air

volume noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

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SECTION 23 37 16 - DUCTSOX HOOPS (IHS) WITH SEDONA-XM NP

PART 1 - GENERAL (Division 15, Section 15800)

1.1 DESCRIPTION OF WORK:

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

B. Types of non-metal ductwork required for this project include the following:

1. Textile Air Dispersion Products.

1.2 QUALITY ASSURANCE:

A. Building Codes and Standards:

1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and UL 2518.
2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.

B. Design & Quality Control

1. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.
2. Manufacturer's Environmental Product Declaration (EPD) must be inclusive of the following:
    a. Fabric
    b. Cutting, sewing, processing of DuctSox
    c. Zippers
    d. Metal suspension system parts and framework (if applicable)
    e. Energy, water, recycled & waste of plant processing fabric & suspension
    f. Complete packaging including boxes, bags & staples
    g. Transportation

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.

B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and UL 2518.

C. Provide detailed drawings confirming configuration of Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).

D. Provide detailed installation instructions for components to be installed.

E. Provide warranty and maintenance documentation.

F. Provide product's Environmental Product Declaration (EPD) that includes the following:
   1. Fabric
   2. Cutting, sewing, processing of DuctSox
   3. Zippers
   4. Metal suspension system parts and framework (if applicable)
   5. Energy, water, recycled & waste of plant processing fabric & suspension
   6. Complete packaging including boxes, bags & staples
   7. Transportation

1.4 WARRANTY:

A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Protect textile air dispersion system and Hoops (IHS) components from damage during shipping, storage, and handling.

B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

Subject to compliance with requirements, choose one of the following:

A. DuctSox® Corporation

   Phone: (866) DUCTSOX or (563) 588-5300

   www.DuctSox.com

2.2 TEXTILE AIR DISPERSION SYSTEM:

A. Hoops (IHS) System: Air diffusers shall be constructed with internal retention system.
   1. System shall consist of an internal 360 degree hoop system, spaced 5' on center.
   2. System shall be installed with a one row suspension system located 1.5" above top-dead-center of the textile system.
   3. System attachment to cable or U-Track shall be made using Gliders spaced 12 inches.
   4. Available for diameters from 8" – 60".
   5. One row suspension options(must specify if multiple on same project)
      a. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.
         1. Cable suspension options(must specify if multiple on same project)
            a. Galvanized steel cable

b. Stainless steel cable
c. Impregnated steel cable(required for natatorium applications)

2. Support lengths available in 5'(standard), 10', 15', & 30'.

b. U-Track suspension hardware to include 8' sections of aluminum track, aluminum splice connectors, track endcaps and vertical cable support kits – consisting of a length of cable with cable connectors. Radius aluminum track must be included for all horizontal/flat radius sections.

1. U-Track suspension options(must specify if multiple on same project)
   a. Galvanized steel cable
   b. Stainless steel cable
   c. Impregnated steel cable(required for natatorium applications)
2. Support lengths available in 5'(standard), 10', 15', & 30'

c. U-Track Surface Mount hardware to include 8' sections of aluminum track, aluminum splice connectors, track endcaps, and U-Track suspension attachments. Radius aluminum track must be included for all horizontal/flat radius sections.

1. U-Track Surface Mount suspension options(must specify if multiple on same project)
   a. U-Clip spring attachment
   b. U-Clip spring attachment with T-Bar clip and rivet

B. TEXTILE

1. Sedona-Xm NP
   a. Textile Construction: Filament/spun plain weave polyester treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518. Also passes AS/NZS 1530.3.
   b. Air Permeability: 0.7 (+/-0.25) CFM/ft^2 per ASTM D737, Frazier
      1. The air permeability of the fabric must NOT be created by perforating the fabric.
      2. The air permeability must be confirmed be third party testing to eliminate the formation of condensate on the fabric.
   c. Weight: 6.5 oz. /yd^2 per ASTM D3776
   d. Warranty: 10 years
2. Textile Color
   a. Standard: blue, white, tan, red, green, silver, black
   b. Custom

C. TEXTILE SYSTEM FABRICATION REQUIREMENTS:

1. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips along the length of the system.
2. Integrated air dispersion shall be specified and approved by manufacturer. (select only those that apply)
   a. Linear Vents
      1. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
      2. Size of vent openings and location of linear vents to be specified and approved by manufacturer.

b. Orifices
    1. Air dispersion and extended throws are accomplished by reinforced orifices and permeable fabric. Reinforced laser-cut orifices retain the integrity of the opening and withstand laundry processes.
    2. Diameter, quantity, and location of reinforced orifices to be specified and approved by manufacturer.
3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.
4. Inlet connection includes zipper for easy removal / maintenance.
5. Lengths to include required intermediate zippers as specified by manufacturer.
6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
7. End cap includes zipper for easy maintenance.
8. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

D. DESIGN PARAMETERS:
1. Textile air diffusers shall be designed from 0.25” water gage minimum to 3.1” maximum, with 0.5” as the standard.
2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
4. Do not use textile diffusers in concealed locations.
5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

PART 3 – INSTALLATION

3.1 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM:

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.2 CLEANING AND PROTECTION:

A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION 23 37 16

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SECTION 23 74 13 CENTRAL STATION AIR HANDLING EQUIPMENT

PART 1: GENERAL –

1.1 SECTION INCLUDES

A. Indoor Air Handling Units.

1.2 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99 - Standards Handbook.

C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

E. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.

F. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

G. AHRI 430 - Central-Station Air-Handling Units.

H. AHRI 435 - Application of Central-Station Air-Handling Units.

I. ASTMB117 - Standard Practice for Operating Salt Spray Apparatus.

J. NEMA MG1 - Motors and Generators.

K. NFPA 70 - National Electrical Code.

L. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

M. UL 723 - Test for Surface Burning Characteristics of Building Materials.

N. UL 900 - Test Performance of Air Filter Units.

O. UL 1995 - Standard for Heating and Cooling Equipment.

P. UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

Q. IBC 2000, 2003 - International Building Code.

R. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

S. NFPA 5000 - Building Construction and Safety Code.

T. ASHRAE 90.1 Energy Code.

U. AHRI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.

V. GSA 2003 Facilities Standard - 5.9 HVAC Systems and Components.

1.3 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.
2. Provide data of filter media, filter performance data, filter assembly, and filter frames.
3. Provide manufacturer's installation instructions.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Air Handler products specified in this section must show a minimum five years documented experience and complete catalog data on total product.

1.5 SAFETY AGENCY LISTED & CERTIFICATION

A. Air Handling units shall be cETLus safety listed to conform with UL Standard 1995 and CAN/CSA Standard C22.2 No. 236. Units shall be accepted for use in New York City by the Department of Building, MEA 342-99-E.

B. Air handler furnished with double width, double inlet (DWDI) fans and/or plenum fans where applicable, shall be certified in accordance with the central station air handling units certification program, which is based on AHRI Standard 430. (NOTE: Above does not apply to fan array)

C. Air handling unit water heating & cooling coils shall be certified in accordance with the forced circulation air cooling and air heating coils certification program, which is based on AHRI Standard 410.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site on factory-furnished shipping skids. Inspect for damage.

C. Store in clean dry place and protect from construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following manufacturers are approved for use. No substitutions will be permitted.

1. Daikin Applied 'Vision' Air Handler shall be the basis of design.
2. Haakon
3. Marlo

2.2 GENERAL DESCRIPTION

A. Configuration: Fabricate as detailed on drawings.

B. Performance: Conform to AHRI 430. See schedules on prints. (NOTE: above does not apply to fan array)

C. Acoustics: Sound power levels (dB) for the unit shall not exceed the specified levels shown on the unit schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

2.3 UNIT CONSTRUCTION

A. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.

B. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.

1. The inner liner shall be constructed of G90 galvanized steel.
2. The outer panel shall be constructed of G90 galvanized steel.
3. The floor plate shall be furnished with 0.044 inch thick aluminum tread plate in sections as indicated on project schedule.
4. The floor plate shall be constructed as specified for the inner liner.
5. A sound baffle shall be secured to the inner liner of selected fan, plenum, access, and manual sections. It shall be constructed of G60 galvanized perforated steel filled with fiberglass insulation.
6. Unit will be furnished with solid inner liners.

C. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.

D. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5” w.c. in positive pressure sections and -6” w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure)

E. The casing leakage rate shall not exceed 1% of supply air volume at design static pressure up to a maximum of +8” w.c. in positive pressure sections and -8” w.c. (1.99 kPa) in negative pressure sections.

F. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.

G. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.

H. AC-4: A 6-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping.. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035 and 10-gauge nominal for unit sizes 040 - 090. The following calculation shall determine the required height of the baserail to allow for adequate drainage. Use the largest pressure to determine base rail height. (Negative)(Positive) static pressure (in) (2) + 4” = required baserail height. Should the unit baserail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.

I. AC-1,2,3: The unit base shall be provided by others.

J. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3’’ above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2’’ thickness of insulation under drain pan.

K. A sound baffle shall be secured to the inner liner of selected fan, plenum, access, and manual sections. It shall be constructed of G60 galvanized perforated steel filled with fiberglass insulation.

L. An optional 0.044" thick aluminium treadplate shall be secured to the floor panel.

2.4 FAN ASSEMBLIES

A. AC-4: Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.

B. AC-1,2,3: Acceptable fan assembly shall be a double width, double inlet, class II, belt-drive type housed forward curved fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Copper lubrication lines shall be provided and extend from the bearings and attached with grease fittings to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field. Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door.

C. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry. Seismic snubbers shall be provided.

2.5 BEARINGS, SHAFTS, AND DRIVES

A. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.

B. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards.

C. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

D. AC-4: The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.

E. AC-1,2,3: V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Fixed sheaves, matched belts, and drive rated based on motor horsepower. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor minimum shall be 1.1 S.F. for 1/4 HP – 7.5 HP, 1.3 S.F. for 10 HP and larger, calculated based on fan brake horsepower.

2.6 ELECTRICAL

A. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), single speed, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.

B. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.

C. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.

D. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.

E. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.

2.7 COOLING AND HEATING COILS

A. Certification: Acceptable water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer’s certification and/or the range of AHRI’s standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced

Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.

B. Direct expansion refrigerant cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 3" beyond unit casing for ease of installation. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

1. Sweat type copper suction headers shall be provided.
2. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
3. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins on 1 1/2-inch centers, brazed at joints.
4. Sweat type copper suction connections located at the bottom of the suction headers for gravity oil drainage. Coils shall be uniformly circuited in a counterflow manner for either single circuit, row, face, interlaced, or interlaced face split capacity reduction as shown on unit schedule. Pressure type liquid distributors used. Coils shall be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure.
5. Coil casing shall be a formed channel frame of galvanized steel.

2.8 FILTERS

A. Furnish flat filter in mixing box section with 2-inch filter. Provide side loading and removal of filters.

B. Furnish flat panel filter section with 2-inch filter. Provide side loading and removal of filters.

C. Filter media shall be UL 900 listed, Class I or Class II.

D. Filter Magnehelic gauge(s) shall be furnished and mounted by equipment manufacturer.

2.9 AC-4 ONLY: ELECTRIC HEAT

A. The air handling unit shall include a UL recognized slip-in style electric heat section. Voltage, size KW, steps and control voltage shall be scheduled.

1. Open coil heating elements shall be 80% nickel and 20% chromium; steps shall be arranged to prevent stratification when operating at less then full capacity. Elements for draw-through air handling units shall be derated to 35 watts per square inch.
2. Element terminals shall be stainless steel; insulators and bracket bushings shall be nonporous ceramic and securely positioned. Terminals shall be machined crimped to elements.

3. Frame should be constructed of heavy gauge galvanized steel with galvanized steel brackets, stiffening ribs and gussets spot welded to the frame.
4. Terminal box shall be spot welded construction with solid, hinged cover, totally enclosed, without louvers or grilles per the UL standard.
5. Airflow direction shall be scheduled. Heater control panel shall be located on same side of unit as drive on fan.
6. Safety devices: a disc-type automatic reset thermal cutout, pressure differential airflow switch, and door interlock switch shall be furnished for primary over temperature protection. All safety devices shall be serviceable through the terminal box without removing the heater from the unit.
7. Wiring Diagrams: a unique wiring diagram shall be furnished for each heater. Diagram shall include recommended supply wire gauges per NEC and fuse sizes. Typical Wiring Diagrams are not acceptable.
8. Built-in components shall include safety devices, disconnecting break magnetic contactors, transformer with primary fusing per UL, pressure type airflow switch set at .05” WC, supplementary circuit fuses per NEC (one set fuses per 48 amp circuit) , and separate load and terminal blocks to accept conductors as shown on the electrical plan.
9. The following control type shall be available: SCR 0-10 VDC: (SCR Vernier Control 0-10 VDC)

2.10 ADDITIONAL SECTIONS

A. Access section shall be provided for access between components.

B. Mixing box section shall be provided with no outside air opening and top return air opening with or without parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided when return and outside air dampers sized for full airflow. Return and outside air dampers of different sizes must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s Installation & Maintenance instructions.

3.2 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION 23 74 13

SECTION 23 74 16 – PACKAGED ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop air conditioners.

1.2 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99—Standards Handbook

C. AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes

D. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

E. AHRI 340/360 - Unitary Large Equipment

F. NEMA MG1—Motors and Generators

G. National Electrical Code.

H. NFPA 70—National Fire Protection Agency.

I. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.

J. UL 900—Test Performance of Air Filter Units.

1.3 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics, and connection requirements.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
2. Provide computer generated fan curves with specified operating point clearly plotted.
3. Manufacturer’s Installation Instructions.

1.4 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance and service.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site and inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Daikin Applied

2.2 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single Zone Heating and Cooling Unit(s) model DPS. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:

1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Gas heating section.
6. Condensing unit section

C. The complete unit shall be cETLus listed.

D. The unit shall be ASHRAE 90.1-2019 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-32 Refrigerant and oil.

F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

I. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.3 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0 on sizes 3-17 tons, and 2" thick with an R-value of 13 for 16-31 Tons, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless-steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal.

2.4 OUTDOOR/RETURN AIR SECTION

A. (DOAS-1&2 REFRIGERATION CONTROLS ONLY) Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator

filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type.

B. (DOAS-1&2, LOBBY, AND FITNESS) (Daikin Applied UltraSeal low leak dampers shall be provided. Damper blades shall be fully gasketed and side sealed and arranged vertically in the hood. Damper leakage shall be less than 1.5 CFM/Sq. Ft. of damper area at 1.0 inch static pressure differential. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers. Control of the dampers shall be from a factory installed actuator.

C. Control of the outdoor dampers shall be by a factory installed actuator. Damper actuator shall be of the modulating type. Damper to open when supply fan starts, and close when supply fan stops.

D. Economizer assembly Fault Detection and Diagnostics (FDD) shall be 90.1, IECC, and California Title 24 compliant. MicroTech III controls shall display a warning, and write a warning to the BAS, if the economizer malfunctions in accordance with 90.1, IECC, and Title 24 specifications.

2.5 ENERGY RECOVERY (DOAS-1&2)

A. The rooftop unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning

B. The unit shall have 2" Merv 8 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door with ¼ turn latches.

C. The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless-steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

D. The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

E. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and

shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning.

F. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.

G. The exhaust air fan shall be a direct drive SWSI plenum fan. The exhaust fan shall be sized for the airflow requirements per the construction schedule. The unit controller shall control the exhaust fan to maintain building pressure. A VFD shall be provided for the exhaust fan motor, or the exhaust fan motor shall be an ECM motor. The rooftop unit shall have single point electrical power connection and shall be ETL listed

H. (REFRIGERATION ONLY CONTROLS) Energy recovery wheel operation and defrost will be operated by a third-party microprocessor controller.

2.6 EXHAUST FAN

A. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

C. The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.7 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 8 and 4" MERV 14 filters.

B. All units shall be provided with a through the wall minihelic filter gauge that displays filter loading on the exterior of the unit.

2.8 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

F. A drain pan overflow safety shall shut off the unit and issue a warning before over flow occurs.

2.9 HOT GAS REHEAT (DOAS-1&2)

A. Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.

B. Hot gas reheat coil shall be a Micro Channel design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

C. The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

D. Each coil shall be factory leak tested with high-pressure air under water.

2.10 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. (DOAS-2 and Gym) All fan assemblies shall employ solid steel fan shafts. Heavy-duty pillow block type, self-aligning, grease lubricated ball bearings shall be used. Bearings shall be sized to provide a L-50 life at 250,000 hours. The entire fan assembly shall be isolated from the fan bulkhead with a flexible collar and mounted on 1” spring isolators.

C. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

D. Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include removable shipping tie downs.

E. (DOAS-1, Lobby, and Fitness) The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

F. (DOAS-2 and Gym) The motor shall be T Frame and open drip proof. Overload protection and speed control is provided by the factory installed VFD and rooftop unit controller. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

G. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

1. All Supply and Exhaust Fans shall include a factory installed flow measuring station. Airflow needs to be readable through the unit controller and building automation system.

2.11 VARIABLE AIR VOLUME CONTROL

A. DOAS Units: The unit controller shall proportionally control the Electronically Commutated Motors (ECM) on the supply and exhaust fans. The supply fan shall be controlled to maintain an adjustable duct pressure setpoint. A duct static pressure sensor shall be factory mounted in the control panel. The field shall furnish and install the pneumatic tubing for the duct static pressure sensor and the building pressure sensor. The field shall furnish and install the outdoor air pressure sensor.

B. Single-Zone Units: The unit controller shall proportional control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and dead band. The unit controller shall provide discharge air temperature control with the compressor modulation.

C. The unit manufacturer shall install all power and control wiring.

D. The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.12 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. The module shall be complete with furnace controller and control valve capable of 5:1 (7-tons or less) or 12:1 (10-tons and larger) modulating operation.

C. The heat exchanger tubes shall be constructed of stainless steel

D. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

E. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

F. The factory installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.13 HEAT PUMP HEATING

A. The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4-way reversing valve for the heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.

B. The refrigerant system shall have a pump-down cycle.

C. The unit shall have a natural gas furnace for hybrid heating. When the heatpump operation cannot maintain the discharge air temperature setpoint the natural gas furnace shall temper the airstream to the discharge air temperature setpoint.

2.14 CONDENSING SECTION

A. Outdoor coils shall have seamless copper tubes, mechanically bonded into aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit in ambient conditions up to 125°F]. Mechanical cooling shall be provided to 0°F. Heat Pump Heating shall be provided to -10F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

C. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.

D. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and an oil separator for each compressor that routes oil back to the compressor instead of through the discharge line.

E. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

F. Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

G. Each circuit shall be dehydrated and factory charged with R32 Refrigerant and oil.

2.15 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. A GFI receptacle shall be unit mounted. The receptacle shall be powered by a factory installed and wired 120V, 15 amp power supply. The power supply shall be wired to the line side of the unit's main disconnect, so the receptacle is powered when the main unit disconnect is off. This option shall include a GFI receptacle, 2.0 KVA transformer and a branch circuit disconnect. The electrical circuit shall be complete with primary and secondary overload protection.

C. An optional fused disconnect and 65,000 amp SCCR capability shall be provided.

2.16 CONTROLS

A. (REFRIGERATION ONLY CONTROLS) The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand-alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

B. (REFRIGERATION ONLY CONTROLS) Provide a microprocessor based system to control all refrigeration functions including compressor speed, condenser fan function, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall operate the unit at peak efficiency utilizing variable head pressure control and electronic expansion valve while maintaining the cooling, or heating in heat pump operation,

call per third party control. The microprocessor control shall consist of only direct expansion required temperature sensors, pressure sensors, controller and keypad/display operator interface. Refrigeration sensors and controller shall be factory mounted, wired and tested.

C. The microprocessor controls shall be solely dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. No commissioning settings shall be lost, even during extended power shutdowns.

D. The microprocessor controls shall be dependent on starting and stopping of the unit via terminal strip control and logic. The control system shall be capable of providing a remote alarm indication. The microprocessor shall provide compressor capacity & status, defrost status (heat pump only), condensate overflow alarm, and dirty filter alarm.

E. All digital and analog inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

F. The keypad interface shall allow convenient navigation and access to the commissioning functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

1. Supply and exhaust fan speed control
2. Refrigeration alarm details.

2.16.1 A2L Leak Mitigation (APPLIES TO COMPRESSORIZED PACKAGE ROOFTOP UNITS)
Refrigerant Detection System (RDS) for compressorized rooftop equipment using A2L refrigerant.

A. Compressorized rooftop equipment using A2L refrigerant shall come equipped with a factory installed Refrigerant Detection System (RDS) in compliance with UL60335-2-40. The factory-installed unit controller will respond and control the unit to comply with UL60335-2-40 according to the alarm status of the refrigerant detection system. See the unit Operations Manual for a detailed sequence of operations.

B. The Refrigerant Detection System (RDS) shall consist of the following components:

1. Dedicated A2L Refrigerant Detection Control Board
2. Refrigerant Sensor or Sensors. The number of sensors will vary based on the product and configuration as needed to comply with UL requirements.

C. Operation and Monitoring:

1. The refrigerant sensor or sensors communicate with the refrigerant detection control board. The refrigerant sensors detect the presence of the A2L refrigerant outside of the sealed refrigeration piping and communicate the levels to the refrigerant detection control board. The refrigerant detection controller communicates the RDS status to the factory-installed unit controller.
2. Alarm Communication: The unit controller will communicate RDS alarms based on the RDS status in the same way as any other alarm. Alarms are triggered by the following: 1)

Refrigerant detected above 15% of the refrigerant lower flammability level (LFL); 2) Refrigerant Sensor Fault.

a. A customer relay is provided for the field to connect directly to the refrigerant detection control board as an alternative means to receive the above two alarm statuses.
b. A customer relay is provided for the field to connect directly to the refrigerant detection control board as an alternative means to receive the above two alarm statuses.

D. Factory unit wiring diagrams must show the refrigerant leak detection system wiring.

2.17 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

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SECTION 23 74 23 - PACKAGED, OUTDOOR, HEATING ONLY-MAKEUP AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes indirect gas-fired heating or heating/make-up air units. Each unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in the "PRODUCTS" section of this specification. If unit is intended for installation on a concrete slab, verify design requirements and construction responsibility for the slab.

1.2 SUBMITTALS

A. All information in this document, as provided by Modine Manufacturing Company, is provided without representation or warranty of any kind as to the user or any other party, including, without limitation, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR NON-INFRINGEMENT. To the greatest extent permitted by applicable law, Modine Manufacturing Company assumes no liability, and the user assumes all liability and risk, for the use or results from the use of this document or the information contained herein, whether as modified by the user or not. This document must be carefully reviewed by the Engineer to ensure it meets the requirements of the project and local building code(s).

B. As Modine Manufacturing Company has a Continuous Product Improvement program, it reserves the right to change design and specifications without notice.

1.3 QUALITY ASSURANCE

A. The duct furnace(s) shall include ETL design certification for use in both the US and Canada to the ANSI Z83.8 - latest revision, standard for "Gas Unit Heater and Gas-Fired Duct Furnaces" for safe operation, construction, and performance.

B. The complete system featuring duct furnace(s) and blower section (and cooling and downturn sections if applicable) shall include ETL design certification and the unit nameplate shall include the ETL/ETL Canada listed mark for use in both the US and Canada and must conform to UL 60335-2-40:2022 Ed.4 and be certified to CSA C22.2#60335-2-40:2022 Ed.4 “Household and Similar Electrical Appliances - Safety - Part 2 - 40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners, and Dehumidifiers”. This includes UL 60335-1 and CSA C22.2#60335-1 “Household and Similar Electrical Appliances - Part 1: General Requirements".

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install an indirect gas-fired heating or heating/make-up air unit. Unit shall be fully assembled, wired, and tested prior to shipment. If unit is intended for installation on a concrete slab, verify design requirements and construction responsibility for the slab.

2.2 MANUFACTURERS

A. The basis-of-design product for the indirect gas-fired heating or heating/make-up air unit is based on the Airedale model OBP.

2.3 MECHANICAL CONFIGURATION

A. Unit(s) shall have right side access, when looking into the discharge, and include:
   1. Furnace section(s) controls.
   2. Blower section containing a supply blower and motor with bottom support to provide rigidity. The blower connection shall be flexible with ¼" gasket to prevent sound transmission into the supply ductwork.
   3. Electrical section isolated from the supply air stream including a hinged access door. Separate conduit entry points shall be provided for both high and low voltage electrical connections. Provisions must be included for side access electrical connections for slab mounted units and bottom electrical connections for roof curb mounted units.

2.4 CABINET

A. Duct Furnace
   1. The duct furnace unit casing shall be constructed of not less than 18 gauge aluminized steel and shall be painted with a baked-on gray-green polyester powder paint (7 mil thickness) for corrosion resistance.
   2. All duct furnace access side doors shall have heavy duty, draw tight, quarter turn latches.

B. Blower Section
   1. The blower section shall be constructed of not less than 18 gauge aluminized steel and shall be painted with a baked-on gray-green polyester powder paint (7mil thickness) for corrosion resistance.
   2. All blower section access side doors shall have heavy duty, draw tight, quarter turn latches.
   3. The blower cabinet shall be insulated as noted below.
   4. The blower cabinet shall include double wall construction as noted below.

C. Insulation
   1. Insulation shall be 1 inch, 1½ lb density acoustical and thermal insulation. The insulation shall be made of glass fibers bonded with a thermosetting resin and

overlaid with a fire-resistant black acrylic coating for additional strength. The acrylic coating must meet the requirements of ASTM C 665 for fungi resistance.

2. Double wall construction shall include a 22 gauge aluminized steel liner that covers the insulation to comply with ASHRAE 62.1 to prevent mold growth, allow easy cleaning, and protection of the insulation from the airstream and from entering the airstream.

D. Other Construction
1. Roof shall be designed for maximum roof rigidity and prevention of standing water and perimeter drip edges to prevent water from dripping into the access doors.
2. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Continuous gasket sealing shall be included between panels and between access doors and openings to reduce air leakage.
3. The unit shall be provided with a 14 gauge, galvanized steel mounting base with lifting and anchoring holes. The base is designed for either curb or slab mounting.

E. Unit shall include an inlet hood with screen that shall be pre-assembled from the factory and provided with internal baffles to prevent water entrainment in the supply air stream.

2.5 AIR CONTROL CONFIGURATION

A. Unit airflow control configuration shall be fresh air dampers with no return air opening for 100% outside air applications. The actuator shall be two-position.
1. All fresh air dampers are ultra-low-leak with self-compensating stainless steel side seals and galvanized steel blades with edge seals. Dampers shall have a maximum Class I leakage resistance (less than 4 CFM/ft² at 1" W.C.) when tested in accordance with AMCA Standard No. 500, Test Methods for Louvers, Dampers, and Shutters.

B. The damper actuator shall be mounted directly to the shaft of the fresh air damper. If return air dampers are provided, a damper linkage rod shall be provided to set the positions of the opposed dampers. As one damper opens, the opposing damper closes.
1. The damper actuator shall be on-off, spring return so when power is disconnected, the damper closes the outside air opening.
2. The damper actuator shall have one normally open and one normally closed end switch to prove that the damper has opened.
3. Damper controls shall be as outlined in the "CONTROLS" section.

2.6 HEATING SYSTEM

A. The unit shall have an indirect fired gas heating section.
1. The gas heat section shall consist of two single furnaces in series. Each furnace rating is 1/2 the total heat rating of the unit.
2. The venting shall be a power exhausted arrangement. The unit shall be tested to insure proper ignition when the unit is subjected to 40 mile per hour wind velocities.
3. A step down transformer from 460V supply voltage to 115V shall be provided for operation of the power exhauster motor.
4. The gas heating section shall be configured for use with Natural Gas. The inlet gas pressure shall be 6-7" W.C. minimum, not to exceed 14" W.C.

5. The thermal efficiency of the section shall be a minimum of 81% for all air flow ranges resulting in a temperature rise range of 20°F-60°F.
6. The heat exchanger(s) shall be made of 20 gauge 409 stainless steel tubes and headers. The flue collector box shall be made of 20 gauge aluminized steel.
7. The burner(s) shall be made of the same material as the heat exchanger with a thickness of not less than 28 gauge. Burner(s) shall have non-clogging, slotted ports with a stainless steel separator strip designed for good lighting characteristics without noise of extinction. The burner(s) shall be located for service removal without disconnecting the main gas supply piping.
8. Each heat exchanger tube shall be individually and directly flame-fired. The heat exchanger tube shall be contoured and dimpled to provide efficient heat transfer and crimped to allow for thermal expansion and contraction.
9. The heat exchanger(s) seams and duct connections shall be certified to withstand 3.0" W.C. external static pressure without burner flame disturbance.
10. The bottom of the unit shall be angled for draining any condensation to the corners of the unit. The condensation shall be removed through openings in the bottom pan.
11. The drain pan shall be constructed of 20 gauge 409 stainless steel.
12. The gas manifold(s) piping shall allow for gas piping connection on the side of the unit for slab mounted units and through the unit bottom for roof curb mounted units. The manifold(s) shall include a ground joint union for ease of servicing of the orifices without removing the burner assembly or main gas valve string.
13. Gas connections to the furnaces shall consist of individually piped manifolds with separate gas valves and separate ignition controllers.
14. A 1/8” manifold pressure tap shall be located after all valves to test the manifold pressure directly before the main burner orifices.
15. The orifices provided may include adjustable air shutters for controlling the primary air mixture.
16. Orifices shall be sized for operation at 0-2000 feet elevation above sea level.
17. The unit shall be provided with a single phase gas control transformer to step down the supply voltage to 24V.
18. The ignition controller(s) shall be 100% shut-off with continuous retry for natural gas.
19. The solid state ignition system shall intermittently light the pilot each time the system is energized. Once the pilot is proven, the main gas valve shall open and allow gas flow to the main burner.
20. Each furnace shall include an automatic reset high limit switch.
21. The unit shall include an air flow proving switch to insure air flow across the heat exchanger before allowing the gas controls to be energized.
22. Each furnace shall include an optional low gas pressure switch(s) prevents the burner from firing if the inlet gas pressure is below the minimum gas pressure.
23. Each furnace shall include an optional high gas pressure switch(s) which prevents the burner from firing if the manifold gas pressure is above the maximum manifold gas pressure.

B. The unit gas controls shall be provided with the following:
1. An electronic modulating gas valve and combination gas valve on the primary furnace and two-stage combination gas valves on successive furnace(s), ignition control on each furnace, and modulating control from the unit mounted microprocessor controller as described in the "Temperature Controls" section of "CONTROLS".
2. The gas controls can modulate the capacity of a single furnace from 40 to 100% of full fire, but by locking out a furnace, turndown is further reduced to 20% as a system.

2.7 SUPPLY AIR BLOWER AND MOTOR

A. The unit shall contain a single supply blower that is supported from the bottom to prevent the blower flanges supporting the weight of the motor. The blower shall be a double width, double inlet (DWDI) forward curved, belt driven assembly.
   1. The blower shall have heavy duty, pillow block ball bearings.
   2. The blower assembly shall include motor and blower vibration isolation using rubber-in-shear grommets.

B. The blower motor shall meet the following requirements:
   1. The motor type shall be Open Drip Proof (ODP).
   2. The motor shall be premium efficiency to meet the Energy Independence and Security Act requirements.
   3. The motor shall be rated for 460/60/3Ph supply voltage.
   4. The motor bearings shall be ball bearings rated for 200,000 hours. Motors not marked as having permanently lubricated bearings will include grease fittings for periodic lubrication.
   5. The motor shall be inverter duty rated.
   6. The motor wiring shall be in flexible metal BX conduit.
   7. The motor shall be provided with an adjustable motor sheave to allow for minor adjustment of the blower rpm at the job site.
   8. The motor shall be controlled by a shipped loose factory supplied variable frequency drive.
   9. The field installed variable frequency drive shall be provided with a field installed UL Type 1 Conformity accessory kit.
   10. Supply air blower controls shall be as outlined in the "CONTROLS" section.

2.8 FILTERS

A. Filter Rating: Filters shall be pleated disposable filters with a Minimum Efficiency Reporting Value of MERV 13 per ASHRAE standard 52.2.

B. The unit shall include a differential pressure switch wired to the main unit microprocessor controller to warn when the filters may be dirty based on a preset maximum pressure drop.

2.9 ELECTRICAL

A. The unit shall have an electrical control center where all high and low voltage connections are made.
   1. All electrical components shall carry UL, ETL, or CSA listing.
   2. The unit shall have a job specific wiring diagram affixed to the interior of the control compartment access door.
   3. Unit shall have single point power lugs to land the power feed conductors from a single power source.
   4. Separate line voltage and low voltage terminal strips shall be provided and all terminal blocks and wires shall be individually numbered.
   5. All electrical wires in the control panel shall be run in an enclosed raceway.
   6. A single step down transformer shall be provided for all unit controls.

B. The unit shall be supplied with a factory installed non-fusible dead-front disconnect switch to disconnect power to the unit for servicing.

C. The unit shall be supplied with a 115V GFCI service receptacle mounted in the blower compartment. This requires a separate 115V power supply.

2.10 CONTROLS

A. The unit shall include a Carel programmable microprocessor controller mounted in a controls compartment outside the airstream. The controller will be programmed with the Modine Controls System(TM) to operate the unit in an energy efficient manner using pre-engineered control strategies. The controller will monitor output from sensors within each unit subsystem and automatically adjust unit operating parameters to maintain programmed setpoints and strategies.
   1. The control system shall contain LED's and/or LCD interface to indicate the power status, communications status, and fault conditions that arise during operation. Fault conditions indicated include but are not limited to supply air sensor failure, outdoor air sensor failure, space sensor failure, mechanical cooling failure, mechanical heating failure, low supply temperature alarm, high supply temperature alarm, and control temperature cooling or heating failure. The controller shall also monitor outside temperature for heating and cooling circuit lockout during mild conditions. If temperatures fall below the low supply temp alarm point, the unit shall be shut down.
   2. The Carel controller shall be capable of independent stand-alone operation with field configuration, setpoint adjustment, and scheduling accomplished at the unit with an integral user interface that includes a backlit LCD display, keypad, and status LEDs to allow the programming of the control parameters (set point, differential band, alarm thresholds) and basic functions by the user (ON/OFF and display of the controlled values).
   3. Remote Control User Interface: The unit shall be provided with a Carel model pDG1 hand-held user interface for the factory Microprocessor Controller. The device features a backlit LCD display and keyboard that displays status of controllers inputs and outputs, allows for unoccupied/occupied set-point changes, displays service settings, allows adjustment of control parameters, and is used for troubleshooting the unit. The device shall be field wired to the unit microprocessor controller via the Carel pLAN network using shielded cable by others.
   4. The controller shall have a full calendar schedule for occupied, unoccupied, and holiday scheduling.
   5. The controller shall retain all programmed values in non-volatile memory in the event of a power failure.
   6. The Carel controller shall include a pCONet interface to provide the ability to communicate and integrate with BACNet® MS/TP communication networks.

B. Damper Controls: The damper controls subsystem shall be controlled by the microprocessor controller as follows:
   1. The damper control shall be 2-position where the fresh air damper opens to 100% outside air when occupied. The fresh air damper closes when the unit is unoccupied or off.

C. Supply Fan Controls: The supply fan controls subsystem shall be controlled by the microprocessor controller as follows:

1. The supply fan control shall be modulating variable frequency drive control based on speed communicated by the Building Management System to a controller R/W variable, within the limits of the unit.

D. Temperature Controls: The temperature controls subsystem shall be controlled by the microprocessor controller as follows:
   1. Supply Air Temperature Control – The Carel controller shall monitor and control the supply air temperature to maintain the desired supply air temperature.
   2. The microprocessor controller shall monitor the following sensors to achieve the control strategy described above:
      a. An outside air temperature only sensor shall be shipped loose for field installation in the outdoor environment.
      b. A supply air temperature only sensor shall be shipped loose for field installation in the supply air ductwork, downstream from the unit discharge to ensure sensing of properly mixed airflow.

E. Other Optional Controls: The unit shall be provided with the following additional controls:
   1. Unit External Enable Relay: The unit shall be provided with a relay wired to a digital input on the unit microprocessor controller that starts the unit in Occupied mode based on contact closure from an external control device by others.
   2. A manual reset supply air fire stat shall shut the system down if the temperature at the limit switch location exceeds 200°F.
   3. A blower door switch that shuts the blower down when the blower door is opened.

2.11 ROOF CURB

A. Roof Curb: The unit shall be supplied with a knocked down, field assembled and installed roof curb.
   1. Construction: The curb shall be 16" high to meet the National Roofing Contractors Association requirements. The curb shall be constructed of 16 gauge galvanized steel and include wood nailing strips and assembly hardware.
   2. Insulation: The roof curb shall be fully insulated with 1 inch, 1-1/2 lb. density acoustical and thermal insulation. The insulation shall be made of glass fibers bonded with a thermosetting resin and overlaid with a fire-resistant black acrylic coating for additional strength. The acrylic coating must meet the requirements of ASTM C 665 for fungal resistance.
   3. Gasketing: Curb gasketing shall be furnished with the curb and is to be affixed to the curb immediately before mounting of the rooftop unit to provide an air seal.
   4. Installation: The curb shall be designed for installation on a flat, non-sloped roof.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit Installation & Service Manual.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit Installation & Service Manual.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's Installation & Service Manual, Best Practices and all applicable building codes.

3.3 CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

B. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.

C. Duct installation and connection requirements are specified in Division 23 (Heating Ventilating and Air Conditioning).

D. Electrical installation requirements are specified in Division 26 (Electrical).

3.4 FIELD QUALITY CONTROL

A. Refer to section 01 40 00 "Quality Requirements" for additional requirements.

3.5 SYSTEM STARTUP

A. Start-up units in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.6 WARRANTY

A. Standard Unit Warranty:
   1. Components excluding Heat Exchangers, Coils, Condensers, Burners, Sheet Metal: Two years from date of first beneficial use by buyer or any other user, within two years from date of resale by buyer in any unchanged condition, or within 30 months from date of shipment from seller, whichever occurs first.
   2. For units equipped with Modine Controls System - All Components Warranty: Two years from date of first beneficial use by buyer or any other user, within two years from date of resale by buyer in any unchanged condition, or within 30 months from date of shipment from seller, whichever occurs first.
   3. Coils, Heat exchangers, Sheet Metal: one year from date of first beneficial use by buyer or any other user, within one year from date of resale by buyer in any

unchanged condition, or within eighteen months from date of shipment from seller, whichever occurs first.

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23 81 29 VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/Condensing unit(s):
      a. Size Range: 6 to 40 Tons Nominal

1.2 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:

   1. The units shall be tested by a National Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
   2. All wiring shall be in accordance with the National Electric Code (NEC).
   3. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
   4. The condensing unit will be factory charged with R410A.

1.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

1.4 WARRANTY

A. STANDARD LIMITED WARRANTY

   1. Complete warranty details available from your local Daikin representative or at www.daikincomfort.com.
   2. Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ''installation date'' which is one of the two dates below:
      a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.
      b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. DESIGN BASIS:

1. The HVAC equipment basis of design is Daikin North America. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Appendix A HVAC Equipment Alternate General Information). In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.

2.2 HVAC SYSTEM DESIGN

A. SYSTEM DESCRIPTION:

1. ACC-1,2,3,4 and HPCC1,2,3,4,7,8: The variable capacity heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat or cool model) system as specified.

2. HPCC-5,6,9,10: The variable capacity heat recovery air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat or cool model) system as specified.

   a. A dedicated hot gas pipe shall be required to ensure optimum heating operation performance.

   b. 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.

3. The system shall consist of multiple evaporators using PID control, REFNET™ joints and headers and Daikin VRV® condenser unit.

4. The condenser shall be a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant.

5. The condensing unit may connect an indoor evaporator nominal capacity up to 200% of the condensing unit nominal capacity. All zones are each capable of operating separately with individual temperature control.

6. The Daikin condensing unit shall be able to connect to indoor unit models CXTQ, FXFQ, FXHQ, FXMQ, FXLQ, FXNQ, FXSQ, FXTQ, FXDQ, FXZQ, FXUQ, FXEQ, FXAQ and

FXMQ_MF, and shall range in capacity from 5,800 Btu/h to 96,000 Btu/h in accordance with Daikin's engineering data book detailing each available indoor unit.

a. The indoor units shall be connected to the condensing unit utilizing Daikin's REFNET™ specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable for a variable refrigerant system.

7. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously. 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.

8. HPCC-5,6,9,10: 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 (BSQ_T / BS_Q54T / BSF_Q54T). 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.

a. Branch selector boxes:

1) The branch selector boxes shall have the capacity to control up to 290 MBH (cooling) downstream of the branch selector box.

2) 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.

3) 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.

b. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.

B. VRV EMERION FEATURES AND BENEFITS

1. Voltage Platform - Heat Pump condensing units shall be available with a 460V/3ph/60 Hz power supply.

2. Single-module outdoor units shall be available from 6 to 20 T in nominal cooling capacity and can be combined to offer up to 40 T in a dual-module configuration, which helps

minimize the overall space required for mechanical equipment and optimize total project costs.

3. The condensing unit shall feature a sealed E-box with a minimum of IP55 rating to provide high dust and moisture protection for reliability

4. Gas Furnace Connectivity – Heat Pump condensing units shall be connectable to Daikin Communicating gas furnaces with AFUE ranging from 80% to 97%.

5. System shall be capable of connecting to multiple VRV A-coils (CXTQ) paired with Daikin Communicating gas furnaces allowing for options of gas or heat pump heating to optimize operational costs based on changing utility costs.

6. The system shall be able to switch between heat pump heating and gas furnace heating at a field selectable change-over temperature which can be configured via condensing unit field settings.

7. Each system shall be able to enlarge from single to dual module without the need for installed main pipe size changes. The manufacturer shall provide predefined pipe sizes and design rules ensuring reliable system operation and offering design flexibility in phased installation applications.

8. Stable Operation – System shall provide stable inverter operation at varied ambient conditions.

9. No Drain Pan Heater – System shall be capable of heating operation without the need for a drain pan heater. If alternate manufacturer is chosen, an additional drain pan heater shall be provided by the manufacturer.

10. Auto Changeover – System shall, below the field selected outdoor ambient temperature provide signal to initiate auxiliary or back up heat.

11. Advanced Zoning - A single system shall provide for up to 64 zones.

12. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve with up to 2000 positions for independent control.

13. VFD Inverter Control and Variable Refrigerant Temperature - Each condensing unit shall use high efficiency, variable speed all “inverter” based flash vapor injection 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.

a. Indoor shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.

14. Configurator software - 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.

    a. 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 purposes.

15. Each system shall include a built-in data recorder that can store up to 40 minutes of operational data which can help identify the issue in case of a product failure.

16. Heating during Defrost and Oil Return. Reverse cycle (cooling mode) in these modes shall not be permitted due to the potential reduction in space temperature.

17. Low Ambient Cooling - Each system shall be capable of low ambient cooling operation to -4°FDB (-20°CDB).

18. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve for independent control.

19. Flexible Design –

    a. Systems shall be capable of up to 540ft (165m) of linear piping between the condensing unit and furthest located indoor unit.

    b. Systems shall be capable of up to 3,280ft (1,000m) total “one-way” piping in the piping network.

    c. Systems shall have a vertical (height) separation of up to 361 ft between the condensing unit and the indoor units.

    d. Systems shall be capable of up to 295ft (90m) from the first REFNET™ / branch point.

    e. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit nominal capacity.

    f. Systems shall be capable of 98ft (30m) vertical separation between indoor units.

    g. 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.

20. Oil return – Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle.

21. Simple wiring – Systems shall use 16/18 AWG, 2 wire, stranded, non-shielded and non-polarized daisy chain control wiring.

22. Each condensing unit shall include a multi-functional digital display that can provide system operation status such as operating refrigerant temperatures, pressures, outdoor electronic expansion valve opening and compressor operation time.

23. Each condensing unit shall include a service window that can provide easy access to system field settings and operation status without completely removing the condensing unit panel.

24. Advanced diagnostics – Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.

25. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.

26. Advanced controls – Each system shall have at least one remote controller capable of controlling up to 16 indoor units.

27. Each system shall be capable of integrating with open protocol BACnet, LonWorks and Modbus building management systems.

28. Low sound levels - Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).

29. The system shall be certified and listed in OSHPD directory for seismic certification

30. The condensing unit can be installed up to 200 ft above the ground without requiring any additional field modifications to the unit to comply with the Florida Miami Dade Wind code requirements.

31. The condensing unit shall be factory equipped with a Schrader valve for connection to a pressure relief kit for compliance with City of Chicago Pressure relief code.

C. PERFORMANCE:

1. Cooling Operation:

    a. The standard operating range will be 23°FDB (-5°CDB) ~ 122°FDB (50°CDB).

    b. Cooling mode indoor room temperature range will be 57-77°FWB (13.9 - 25°CWB).

2. Heating Operation:

    a. The standard operating range in heating will be -13° – 61°FWB (-25 – 15.6°CWB).

1) 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

b. Heating mode indoor room temperature range will be 59°FDB - 80°F DB (15°CDB – 26.7°CDB).

2.3 EQUIPMENT

A. ELECTRICAL:

1. The power supply to the condensing unit shall be 460V / 3ph / 60 Hz. Voltage Range: 416V – 508V (±10%)

2. Each multi-module outdoor condensing unit shall include a ventilated NEMA 3R UL508A Single-Point Power Panel (SPPP) with Thru-the-Door main input disconnect for termination by the EC on the line side lugs. This field-installed panel shall be rated for 100 kAIC and include Class J, Time delay, dual element fuses, voltage/phase monitoring, fused primary/secondary control transformer, and all required branch circuit protection. Power wiring between SPPP and individual module terminal blocks shall be provided by EC.

B. WIRING:

1. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.

2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.

3. The control wiring shall be 16/18 AWG, 2 wire, non-polarity, non-shielded, stranded

C. REFRIGERANT PIPING:

1. The system shall be capable of refrigerant piping up to 540ft (165m) actual or 623ft (190m) equivalent from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280ft (1,000m) of piping between the condensing and indoor units, without any oil traps or additional components

2. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance.

a. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

2.4 OUTDOOR/CONDENSING UNIT

A. GENERAL:

1. The condensing unit is designed specifically for use with VRV series components.

2. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll P-Type compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver and suction accumulator.

3. Liquid and suction lines must be individually insulated between the condensing and indoor units.

4. The condensing unit can be wired and piped with access from the left, right, rear or bottom.

5. The connection ratio of indoor units to condensing unit shall be permitted up to 200% of nominal capacity.

6. Each condensing system shall be able to support the connection of up to 64 indoor units dependent on the model of the condensing unit.

7. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The condensing unit shall be capable of operating automatically at further reduced noise during night time or via an external input.

8. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.

9. The condensing unit shall be modular in design and should allow for side-by-side installation.

10. The following safety devices shall be included on the condensing unit; high pressure sensor and switch, low pressure sensor with switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

11. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.

12. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.

13. The condensing unit shall be capable of heating operation at -13°F (-25°C) wet bulb ambient temperature without additional low ambient controls or an auxiliary heat source.

B. UNIT CABINET:

1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed galvanized steel panels coated with a baked enamel finish.

2. Each condensing unit shall have a three-segment panel design which allows for direct access to outdoor fans, critical mechanical and electrical components separately for ease of installation and service.

3. Each outdoor unit shall have separate knock-outs for both refrigerant piping and wiring on the bottom panel.

C. FAN:

1. The condensing unit shall consist of one or more propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.

2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.

3. The condensing unit shall have configurable settings for intermittent fan operation to help minimize snow accumulation on fan blades when the system is off.

4. Each outdoor unit fan shall be a vertical discharge configuration and the nominal airflow rate for each module will range from 6,200CFM to 14,505 CFM dependent on model specified.

5. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.

6. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. SOUND:

1. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps:

    a. Night Model Level 1 = 55 dB(A), Level 2 = 50 dB(A), Level 3 = 45 dB(A)

E. CONDENSER COIL:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.

3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.

4. The fins shall be coated with an anti-corrosion hydrophilic blue coating as standard from factory with a salt spray test rating of 1000hr per ASTM B117 test standards.

5. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for a drain pan heater. The lower part of the coil shall be used for inverter cooling and be on or off during operation enhancing the defrost operation.

    a. An alternate manufacturer must provide a drain pan heater to enable adequate defrosting of the unit in defrost operation.

6. The condensing unit shall be factory equipped with condenser coil guards on all sides.

F. COMPRESSOR:

1. The Daikin inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit.

    a. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value.

        1) Non–inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.

2. The inverter driven compressors in the condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “P-type”.

3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type.

    a. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

4. The capacity control range shall be as low as 1% to 100%.

5. The compressor’s motor shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.

6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

7. Oil separators shall be standard with the equipment together with an intelligent oil management system.

8. The compressor shall be mounted on vibration dampening rubber grommets to minimize the transmission of vibration, eliminating the standard need for external spring isolation.

9. In the event of compressor failure, the remaining compressors, if applicable, shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be manually activated to specifically address this condition for single module and manifold systems.

10. In the case of multiple condenser modules, combined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours. When connected to a central control system sequential start is activated for all system on each DIII network.

2.5 BRANCH SELECTOR UNITS (HPCC-5,6,9,10)

A. GENERAL:

1. SINGLE-PORT BRANCH SELECTOR BOX

a. The BSQ36TVJ, BSQ60TVJ, and BSQ96TVJ, are designed specifically for use with VRV IV, VRV IV X, VRV EMERION, VRV AURORA, and T-series Water Cooled heat recovery system components.

b. The single port branch selector boxes BSQ_T shall provide individual control and changeover for one group of indoor units.

c. These BSQ_T branch controllers shall support low ambient cooling down to −4F° to connected indoor units.

d. These selector boxes shall be factory assembled, wired, and piped.

e. These branch selector boxes shall have a heat-by-pass control loop inside the units to prevent overheating of space during heating cycles

f. These selector boxes must be mounted indoors.

g. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

2. STANDARD MULTI-PORT T-SERIES BRANCH SELECTOR BOX

a. The BS4Q54TVJ, BS6Q54TVJ, BS8Q54TVJ, BS10Q54TVJ and BS12Q54TVJ, are designed specifically for use with VRV IV, VRV IV X, VRV EMERION, VRV AURORA, and T-series Water Cooled heat recovery system components.

b. These branch selector boxes shall provide individual control and changeover for multiple groups of indoor units.

c. These selector boxes shall be factory assembled, wired, and piped.

d. These selector boxes must be mounted indoors.

e. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

3. MULTI-PORT FLEX BRANCH SELECTOR BOX SERIES

a. The BSF4Q54TVJ, BSF6Q54TVJ, and BSF8Q54TVJ are designed specifically for use with VRV IV, VRV IV X, VRV EMERION VRV AURORA, and T-series Water Cooled heat recovery system components.

b. These branch selector boxes shall provide individual control and changeover for multiple groups of indoor units.

c. These branch selector boxes shall allow for Field selectable LEFT/RIGHT/PASS THROUGH piping configuration.

d. These branch selector boxes shall allow multiple branch selector boxes to be connected downstream of the first Branch selector box in series in series.

e. These Branch selector boxes when connected in series shall be able to support a total indoor load of up to 230MBH.

f. The EEV heads and motors used in the branch selector box shall be accessible via a quick access panel without disassembly of the electrical box.

g. The electrical box of the 4-port branch selector box shall be field re-locatable to left, right, and back side of the main cabinet.

h. These branch selector boxes shall allow connected indoor units to operate in cooling mode down to -4F without any additional field installed accessories

i. Labels shall be displayed close to the incoming 3 pipes to facilitate clear identification and eliminate cross piping.

j. The branch selector boxes shall employ EEV with the ability to control up to 6000 pulses

k. These selector boxes shall be factory assembled, wired, and piped.

l. These selector boxes must be mounted indoors.

m. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

B. UNIT CABINET

1. These units shall have a galvanized steel plate casing.

2. Each cabinet shall house 3 electronic expansion valves for refrigerant control per branch.

3. The cabinet shall contain one subcooling heat exchanger per branch.

4. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.

5. Nominal sound pressure levels shall be measured and published on the submittals by the manufacturer. The sound levels must not exceed the values below.

6. If an alternative manufacturer is selected, the mechanical contractor shall provide, at their own cost and expense, any additional material and labor to meet the below published sound levels

C. REFRIGERANT VALVES:

1. The unit shall be furnished with 3 electronic expansion valves per branch to control the direction of refrigerant flow. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.

2. The refrigerant connections must be of the braze type.

3. In multi-port units, each port shall have its own electronic expansion valves. If common expansion/solenoid valves are used, redundancy must be provided.

4. Multiple indoor units may be connected to a branch selector box with the use of a REFNET™ joint provided they are within the capacity range of the branch selector.

D. CONDENSATE REMOVAL:

1. The unit shall be hermetically sealed to prevent condensation build up inside the unit, and not require use of a secondary condensate collection pan. A safety device or secondary drain pan shall be installed by the mechanical contractor to comply with the applicable mechanical code, if an alternate manufacturer is selected.

E. ELECTRICAL:

1. The unit electrical power shall be 460 volts, 1 phase, 60 hertz.

2. The unit shall be capable of operation within the limits of 187 volts to 255 volts.

3. The minimum circuit amps (MCA) shall be 0.1 and the maximum overcurrent protection amps (MOP) shall be 15.

4. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable.

2.6 INDOOR/EVAPORATOR UNITS

2.6.1 FXMA - CONCEALED CEILING DUCTED UNIT (High Static)

A. General Requirements:

1. All indoor/evaporator units shall be factory assembled and tested DX-fan coil units, operable with refrigerant R32.

2. All units shall be completely factory assembled and tested, and shall be charged with dehydrated air prior to shipment from the factory.

3. All units shall be equipped with an electronic expansion valve controlled using a PID loop to automatically adjust the refrigerant flow rate through the unit.

4. All units shall be equipped with a programmed drying operation that dehumidifies while limiting changes in room temperature when used with Daikin remote controllers BRC1NRV71.

5. All units shall feature self-diagnostics, auto-restart functionality, 3-minute fused time delay, and a test run switch.

6. All refrigerant piping, both liquid and suction, shall be fully insulated from the outdoor unit.

B. Indoor Unit:

1. The Daikin indoor unit FXMA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.

2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. The unit shall have signal output in event of leak to connect to external ventilation, damper, alarm etc.

3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

4. Both refrigerant lines shall be insulated from the outdoor unit.

5. The indoor units shall be equipped with a return air thermistor.

6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

7. The voltage range will be 253 volts maximum and 187 volts minimum.

C. Unit Cabinet:

1. The unit cabinet shall be constructed of heavy gauge galvanized steel.

2. The unit shall be internally insulated and shall be capable of installation in indoor environments up to 80% relative humidity without requiring additional field installed insulation.

3. The unit shall ship from the factory in a rear-return configuration and shall be field-convertible to a bottom-return configuration.

4. The unit shall be equipped with a return air thermistor.

5. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

D. Fan:

1. The fan shall be a direct-drive, brushless DC fan motor with (3) user-selectable fan speeds (H, M, L).

2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.

3. The unit shall be equipped with internal controls to allow the fan to automatically select the operating fan curve to deliver nominal airflow CFM (within +/- 10%) when the connect ductwork has been designed with a total external static within the range of the FXMA. This setting shall be accessible as a setting to be used during startup and commissioning of the system

4. The fan motor shall be capable of Auto fan speed control when the unit is connected to the BRC1NRV71 Navigation Remote Control. The Auto fan speed control shall automatically adjust the unit's fan speed in response to the difference between the indoor unit's current set point and the current room temperature measurement. The Auto fan speed control shall utilize (5) fan speeds.

5. The fan motor shall be internally isolated using rubber grommets to reduce transmission of vibrations to the unit.

6. The airflow rate shall be available in three settings.

7. The fan motor shall be thermally protected.

E. Fan Blade

1. The fan blade shall be constructed of lightweight polymer.

2. The fan blade shall be statically and dynamically balanced to minimize vibration.

F. Coil:

1. Coils shall be of the direct expansion type, constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

3. The coil shall be 2 or 3 row cross fin copper evaporator coil with 18 fpi design, completely factory tested.

4. The refrigerant connections shall be flare connections.

5. Factory mounted thermistors shall be installed on the liquid and gas lines.

G. Condensate Drainage

1. The unit shall be equipped with a condensate drain pan under the coil.

2. The condensate drain outlet shall be of PVC construction and VP25 (1” ID, 1-1/4” OD).

3. The unit shall be equipped with a factory-integral condensate pump capable of 25-5/16” lift from the condensate drain outlet. The condensate pump shall be equipped with a float switch to automatically stop unit operation and provide a system error code in the event drain pan water level rises too high.

H. Electrical:

1. Provide a separate power supply connection of 208/230V, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.

2. Refer to the engineering data book for all other electrical data including MCA, MOCP, and FLA values.

3. The transmission (control) wiring distance between the indoor unit and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

4. The transmission (control) wiring between the indoor unit and the remote controller shall be a maximum distance of 1,640 feet.

I. Control:

1. The unit shall be controlled with a Daikin remote controller to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a building management system (BMS) via optional BACnet or LonWorks gateways.

3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

2.7 FXTA – MULTI-POSITION AIR HANDLING UNIT

A. General: Daikin indoor unit FXTA shall be a floor mounted vertical, horizontal left, horizontal right, or downflow air handling unit, operable with refrigerant R32, equipped with an electronic expansion valve and direct-drive ECM type fan with constant CFM programming, for installation within a conditioned space. When installed in a vertical configuration it shall have top discharge air and bottom return air. When installed in a horizontal right or horizontal left configuration, it shall have a horizontal discharge air and horizontal return air. When installed in a downflow configuration it shall have bottom discharge and top return air. This compact design with pre-painted heavy-gauge steel casing shall be available in capacities from 9,500 Btu/h to 60,000 Btu/h. Model numbers are FXTA09AAVJUA, FXTA12AAVJUA, FXTA18AAVJUA, FXTA24AAVJUA, FXTA30AAVJUA, FXTA36AAVJUA, FXTA42AAVJUA, FXTA48AAVJUA , FXTA54AAVJUA, and FXTA60AAVJUA to be connected to outdoor unit model RXTA VRV-S Heat Pump. The FXTA_TB series may also be specified to utilize a factory integral disconnect switch. Model numbers including the factory disconnect are FXTA09AAVJUD, FXTA12AAVJUD, FXTA18AAVJUD, FXTA24AAVJUD, FXTA30AAVJUD, FXTA36AAVJUD, FXTA42AAVJUD, FXTA48AAVJUD , FXTA54AAVJUD, and FXTA60AAVJUD. A KRCS01-6B dremote temperature sensor kit shall be required for all FXTA indoor units not utilizing the thermistor in the Daikin remote controller BRC1NRV71. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism

that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1NRV71.

B. Indoor Unit:

1. The Daikin indoor unit FXTA_AA components shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, brazed connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

3. Both refrigerant lines shall be insulated from the outdoor unit.

4. Return air shall be through an optional or field supplied filter.

5. Condensate draining shall be made via gravity or external condensate pump.

6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

7. The voltage range will be 253 volts maximum and 187 volts minimum.

C. Unit Cabinet:

1. The cabinet shall be constructed with sound absorbing, foil-faced insulation to control air leakage.

2. Select an installation location with adequate structural support, space for service access and clearance for air return and supply duct connections.

3. A field supplied secondary drain pan shall be installed where required by national, state, or local code.

D. Fan:

1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.

2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.2 to 1.0. HP.

3. The airflow rate shall be available in high setting.

4. The fan motor shall be thermally protected.

5. Fan motor external static pressure for nominal airflow:

E. Filter:

1. The return air shall be filtered by means of an optional or field supplied filter.

F. Coil:

1. Coils shall be of the direct expansion type constructed from aluminum tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

3. The coils shall be a 2- to 4-row cross fin copper evaporator coil with 14 to 16 fpi design completely factory tested.

4. The refrigerant connections shall be brazed connections and the condensate will be 3/4 inch outside diameter PVC.

5. A thermistor will be located on the liquid and gas line.

G. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

2.8 Remote Controllers

A. Daikin VRV local remote controllers are compatible with all VRV indoor units. The remote controller wiring consists of a non-polar two-wire connection to the indoor unit. The local remote controllers may be wall-mounted and can be adjusted to maintain the optimal

operation of the connected indoor unit(s). Temperature setpoint can be adjusted in increments of 1°F/°C. In the cases where a system or unit error may occur, the VRV controllers will display a two-digit error code and the unit address. The local remote controllers do not need to be addressed.

B. Madoka Remote Controller BRC1H71W

1. The Madoka Remote Controller can provide control for all VRV indoor units. The remote controller wiring consists of a non-polar two-wire connection to the indoor unit at terminals P1/P2. The Madoka Remote Controller is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s). The Madoka Remote Controller does not need to be addressed.

2. A maximum of 2 Madoka remote controllers can be placed in the same indoor unit control group.

3. Mounting:

    a. The Madoka Remote Controller can be mounted onto a drywall.

    b. The Madoka Remote Controller can be mounted onto an electrical component box.

    c. Mounting plate, screws, and anchors are provided in the packaging.

4. Display Features:

    a. The Madoka Remote Controller is approximately 3.35” x 3.35” x 0.98” in size with a 1.00” x 1.51” LCD display.

    b. The contrast of the LCD display shall be adjustable.

    c. The brightness of the LCD display backlight shall be adjustable.

    d. The controller LED light brightness shall be adjustable or turned off

        1) The LED light shall be able to indicate different status: blue on for indoor unit on, off for indoor unit off, green for Bluetooth connection, and red for error.

    e. Display language shall be selectable from English, French or Spanish.

    f. Selectable display – text mode, icon mode, text scale mode, and icon scale mode

        1) The remote controller shall be able to set to a scale view with a slider to adjust the setpoint ±3 °F from a reference temperature where actual setpoint and room temperature are not displayed.

    g. Status icons on the home screen are configurable to be displayed or hidden.

        1) The setpoint can be displayed or hidden when the indoor unit is off.

        2) The room temperature, operation mode can be displayed or hidden from the home screen

        3) The operation mode can be displayed or hidden when the indoor unit is off

        4) The fan speed can be displayed, hidden, or hidden only when the indoor unit is off.

        5) The louver position can be displayed, hidden, or hidden only when the indoor unit is off.

        6) The master-controller icon can be displayed, hidden, or hidden only when the indoor unit is off.

        7) The error, setback, under-centralized-control, and standby icon can be displayed or hidden.

    h. The controller shall display temperature setpoint in one-degree increments with a range of 60-90^{o}F (16-32^{o}C)

    i. Display of temperature information shall be configurable for Fahrenheit or Celsius

j. Error codes will be displayed with a two-digit code in the event of system abnormality/error.

k. The remote controller shall have two levels of menu access: user/ administrator and installer.

l. The admin menu and installer menu can be protected by a password to prevent unauthorized access.

5. Basic Operation:

    a. Capable of controlling a group of up to 16 indoor units.

    b. Controller shall control the following group operations:

        1) On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto* (*for both VRV Heat Recovery and Heat Pump Systems))

            1. Configure only the essential modes to be selectable – remove unnecessary mode selection(s) from display

        2) Independent Cooling and Heating setpoints in the occupied mode

            1. Dual setpoints (individual Cool and Heat setpoints with minimum setpoint differential 0 – 8°F (0 – 4°C) default 2°F (1°C)) or Single setpoint

        3) Independent Cooling Setup and Heating Setback setpoints in the unoccupied mode

        4) Fan Speed

            1. Up to 5 speeds (dependent on indoor unit type)

        5) Vane direction and oscillation (dependent on indoor unit type)

        6) Airflow direction

            1. Up to 5 louver positions and swing or auto louver

        7) Individual airflow

            1. Provides individual control of up to four (4) louvers on an indoor unit.

        8) Dual airflow

            1. Provides control of both internal and external louver positions

        9) Automatic draft protection

            1. Automatically prevents air flow from blowing directly on occupants.

        10) The controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating in the occupied period.

        11) The controller shall be able to lock its buttons.

        12) The controller shall be able to assign indoor unit group address.

13) The controller shall be able to assign the indoor unit and outdoor unit Airnet address.

14) Filter indicator

1. Filter service indicator shall be displayed after 100, 1250 or 2500 (default) hours of run time configurable via field setting

15) Clock (12/24 hour) display

16) Automatic adjustment for Daylight Savings Time (DST)

1. Set changeover period (second Sunday in March / first Sunday in November)

6. Programmability:

a. The Controller shall support Auto-changeover mode for both Heat Pump and Heat Recovery systems, therefore, allowing the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat according to the room temperature and temperature setpoint.

1) Changeover to cooling mode shall occur at cooling setpoint + 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration

1. Configurable from 1 – 4°F (0.5 – 2°C)

b. Changeover to cooling mode shall occur at the primary changeover deadband to cooling + 1°F (0.5°C) as the secondary changeover deadband.

1) Configurable from 1 – 4°F (0.5 – 2°C)

c. Changeover to heating mode shall occur at heating setpoint - 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration

1) Configurable from 1 – 4°F (0.5 – 2°C)

d. Changeover to heating mode shall occur at the primary changeover deadband to heating - 1°F (0.5°C) as the secondary changeover deadband.

1) Configurable from 1 – 4°F (0.5 – 2°C)

e. 1 hour guard timer

1) Upon changeover, guard timer will prevent another changeover during this period.

2) Guard timer is ignored by a change of setpoint manually from either the Multi-zone Controller, Remote Controller, or by schedule.

3) The Guard timer is also ignored if the space temperature reaches the secondary changeover deadband (configurable from 1 - 4°F (0.5 – 2°C)) from the primary changeover deadband, and the guard timer has been activated

4) 60 minutes as default, configurable to 15, 30, or 90 minutes

f. The controller shall support the Auto-setback by sensor function (dependent on indoor unit type)

1) The cooling and heating setpoints shall gradually relax (configurable) internally when the room is determined to be unoccupied

1. The internal setpoint shall return to the original setpoint when room occupancy is detected

g. The controller shall support the Auto-off by sensor function (dependent on indoor unit type)

1) The indoor unit shall turn off when it is determined that the room is unoccupied after a specified time has elapsed

1. The indoor unit shall be turned on manually when occupancy is detected

h. The controller shall support the Filter Auto Clean function to be performed once a day (dependent on indoor unit type)

1) Eight (8) time periods (00:00-03-00, 03:00-06:00, 06:00-09:00, 09:00-12:00, 12:00-15:00, 15:00-18:00, 18:00-21:00, 21:00-00:00) shall be available to select from to enable the automatic filter cleaning function

1. Default time period (00:00 to 3:00) shall be used if the period for filter auto cleaning is not specified

2) The indoor unit shall be stopped during auto filter cleaning function operation

i. The room temperature shall be capable of being sensed at either the Remote Controller, the indoor unit return air temperature sensor (default), or Remote Temperature Sensor (KRCS01-1B/KRCS01-4B/KRCS01-6B/ KRCS01-2UA/KRCSH2018-01) configured through the field settings.

j. The controller shall support room temperature offset range of -5.4°F (-3.0°C) to 5.4°F (3.0°C) during Cool, Heat, Fan and Auto modes configured through the field settings.

C. Connectivity

1. The remote controller shall come with a Bluetooth connectivity to allow for quick configuration using Android/IOS App. The following settings can be set through the app:

    a. Field settings

    b. Airnet address setting

    c. Indoor unit settings (depends on indoor unit model)

        1) Enable/disable filter auto clean and time

        2) Enable/disable auto draft prevention

        3) Enable/disable auto setback: increment,

        4) Auto-setback by sensor

        5) Auto-off by sensor

    d. Setpoint configuration

        1) Dual/Single

        2) Minimum setpoint differential

    e. Setpoint range limitation for cooling and heating respectively

    f. Enable/Disable setback function

        1) Cooling and heating setback temperature

        2) Cooling and heating setback recovery differential

    g. Remote controller function prohibition

        1) Prohibit buttons

        2) Prohibit mode change

        3) Prohibit fan speed change

        4) Prohibit louver direction change

        5) Prohibit setpoint change

        6) Prohibit specific mode(s): Auto, Cool, Heat, Fan, and Dry

h. Display setting

1) Date and time with DST

2) C/F selection

3) Backlight and LED light brightness

4) Heat and Cool reference setpoint for scale view display mode

i. Admin menu password

j. Installer menu password

2. The Bluetooth app shall have two level of access: administration mode, and installer mode. A QR code needs to be scanned in order to access the installer mode

3. The Bluetooth app shall allow users to create and save setting templates and allow user to send pre-configured template to multiple controllers.

4. The Bluetooth app shall be capable of browsing the settings from the indoor unit and controller.

2.9 DMS502B71: Interface for use in BACnet

A. General

1. The Interface for use in BACnet shall provide the ability for a Building Management System (BMS) to control all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter.

2. It shall be capable of controlling a maximum of 2 DIII-Net systems or 64 indoor unit groups (128 indoor units) connected to a maximum of 10 outdoor units on each DIII-Net system. Each DIII-Net system is independent of each other, and each DIII-Net system will terminate on its own DIII-Net port (2 DIII-Net ports standard).

3. The Optional DIII Board (DAM411B51) can be added to the interface. This option provides 2 additional DIII-Net ports to the interface; a total of 4 DIII-Net ports (maximum of 64 indoor unit groups per DIII-Net port) which can handle a maximum of 256 indoor unit groups (512 indoor units) and 40 outdoor units.

4. The Interface for use in BACnet shall support operations superseding that of the Daikin centralized controller, local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

5. The Interface for use in BACnet uses a standard open protocol based on ANSI/ASHREA Standard 135. The BACnet Interface has been certified by the BACnet Testing Laboratories (BTL). The BACnet Interface is compatible with BACnet IP (ISO16484-5).

6. The interface wiring shall consist of a non-polar two-wire connection to the terminals F1F2 (out-out) of the outdoor unit. The Interface for use in BACnet is wall mounted and is used as a translator between the BACnet Building Management System (BMS) and the VRV DIII-Net communication bus to maintain the optimal operation of the connected indoor unit(s).

7. The Interface for use in BACnet can be used in conjunction with following remote controllers to control the same indoor unit groups,

    a. BRC1E71/ 72/ 73 (Navigation Remote Controller)

    b. BRC2A71 (Simplified Remote Controller),

    c. BRC4C82/ 7E83/ 7C812/ 7E818 (Wireless Remote Controller),

    d. BRC1H71W (Madoka Remote Controller)

    e. No more than 2 remote controllers can be placed in the same group. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together.

8. The Interface for use in BACnet can be used in conjunction with following centralized controllers to control the same indoor unit groups,

    a. DCS601C71 (Intelligent Touch Controller (ITC)) with or without the DCS601A72 (ITC DIII Plus Adapter)

    b. DCM601A71 (intelligent Touch Manager (iTM)) with or without the DCM601A72 (iTM Plus Adapter)

9. Manual addressing is required of each indoor unit group associated with the Intelligent Touch Controller, intelligent Touch Manager and the Interfaces for use in BACnet.

10. The Interface for use in BACnet shall be equipped with one RJ-45 Ethernet port to support interconnection with a network PC via the Internet or Local Area Network (LAN). The Ethernet connection shall be capable of transmission on 10Base-T and/or 100Base-TX connection at 100 Mbps.

11. The Interface for use in BACnet shall be capable of being configured as a foreign device. It shall be capable of communicating across BACnet Broadcast Management Devices (BBMD) in different subnet networks.

12. The Interface for use in BACnet shall be capable of supporting Change of Value (COV) notification for all available objects.

13. The Daikin BACnet Setup Tool shall be available so that certified commissioning personnel/facility staff can securely log into each Interface for use in BACnet via a PC to support the configuration and testing of the Interface for use in BACnet.

14. Mounting: The Interface for use in BACnet shall be mounted on the wall or in an enclosure.

B. Features:

1. The Interface for use in BACnet shall be approximately 10.81” x 10.34” in size.

2. LED display provides the interface’s operational status and alarm.

3. The Interface for use in BACnet shall be capable of displaying indoor unit objects on the BACnet building management system.

4. The Interface for use in BACnet shall provide the BACnet building management system the capability to command the setpoint temperature in 1^0F (0.10^0C) increments with a range acceptable to indoor unit. Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius

5. The Interface for use in BACnet shall provide the BACnet building management system the capability to display the room temperature in 0.10^0F (0.10^0C) increments Display of room temperature information shall be configurable for Fahrenheit or Celsius

6. Error codes generated by the indoor units, outdoor units, branch selector boxes, and remote controllers shall be displayed on the BACnet building management system in the event of system abnormality/error with a two-digit error code as specified by Daikin. Communication errors between the Interface for use in BACnet and the BACnet building management system shall be displayed with a red flashing LED on the Interface for use in BACnet

C. Basic Operation:

1. The Interface for use in BACnet will provide up to 31 objects that can be monitored/controlled via the BACnet building management system (see the Interface for use in BACnet Design Guide – EDUS72-749C) Capable of controlling up to 64 indoor unit groups (128 indoor units) per DIII-Net port (2 DIII-Net ports standard). Optional DIII Board (DAM411B51) can be added to increase DIII-Net ports to a total of 4 DIII-Net ports.

This provides a total of 256 indoor unit groups (512 indoor units) that can be monitored and controlled via the BACnet building management system

2. The Building Management System shall control the following group operations:

    a. On/Off

    b. Operation Mode (Cool, Heat, Fan, Auto, and Dry)

    c. Single setpoint setting for Cooling and Heating in the occupied mode.

    d. Fan status

    e. Fan Speed

    f. Up to 3 speeds (dependent upon indoor unit type)

    g. Vane direction (dependent upon indoor unit type), 5 fixed positions or swing positions

    h. Remote controller permit/prohibit of On/Off, Mode, and Setpoint

    i. Filter sign reset for indoor units

    j. Disable the Intelligent Touch Controller or Manager.

    k. Forced off for indoor units

    l. Forced Thermo-off for indoor units

    m. Energy saving offset of indoor unit setpoint

    n. Compressor status

    o. Thermo-on status

    p. Heater status

3. Capable of providing battery backup power for up to 3 years in total time for the clock for settings stored in non-volatile memory

D. Programmability:

1. The BACnet building management system shall support weekly schedule settings through its programming.

    a. The schedule shall support the indoor unit On/Off

    b. Each scheduled event shall specify time and target group

    c. Each scheduled event shall include On/Off, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, Setup (Cooling) setback setpoint, Setback (Heating) setback setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable

    d. Setback (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied) by Group

    e. An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BACnet building management system programming.

2. The BACnet building management system shall support auto-changeover through its programming.

    a. Auto-change shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint temperature.

    b. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or the same branch selector box in the Heat Recovery system.

    c. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint, Differential to be determined by BACnet building management system programming

    d. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint. Differential to be determined by BACnet building management system programming

    e. Guard timer: Upon changeover, guard timer will prevent another changeover during this period. Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule. Guard timer to

be configured by BACnet building management system programming (30 minute minimum recommended)

3. The Interface for use in BACnet shall support force shutdown of associated indoor unit groups.

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 compressor and condenser units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where compressor and condenser units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Install heat pump units on mounting base.

C. Install roof-mounting units on equipment supports specified in Division 07.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 CONNECTIONS

A. Comply with requirements for piping in other Division 23 Sections. Drawings indicate general arrangement of equipment, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

D. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.

2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Compressor and condenser units will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 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 and perform the following:

a. Inspect for physical damage to unit casing.

b. Verify that access doors move freely and are weathertight.

c. Clean units and inspect for construction debris.

d. Verify that all bolts and screws are tight.

e. Adjust vibration isolation and flexible connections.

f. Verify that controls are connected and operational.

B. Lubricate bearings on fan motors.

C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

D. Adjust fan belts to proper alignment and tension.

E. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

F. Measure and record airflow and air temperature rise over coils.

G. Verify proper operation of condenser capacity control device.

H. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

I. After startup and performance test, lubricate bearings.

3.6 DEMONSTRATION

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

END OF SECTION 23 81 29

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SECTION 23 82 16 - AIR COILS

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 types of air coils that are not an integral part of air-handling units:

1. Electric.

B. Related Sections include the following:

1. Division 23 Sections for air coils that are integral to air-handling units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air coils 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, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

1.5 PROJECT CONDITIONS

A. Altitude above Mean Sea Level: 500 feet.

PART 2 - PRODUCTS

2.1 ELECTRIC COILS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Brasch Manufacturing Co., Inc.
2. Chromalox, Inc., Wiegand Industrial Division; Emerson Electric Company.
3. Dunham-Bush, Inc.
4. INDEECO.
5. Trane.

D. Coil Assembly: Comply with UL 1995.

E. Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.

F. Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, and fastened to supporting brackets.

G. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.

1. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.

H. Frames: Galvanized-steel channel frame, minimum 0.0625 inch (1.6 mm) thick for flanged mounting.

I. Control Panel: [Unit mounted with disconnecting means and overcurrent protection. Include the following controls:

1. Magnetic contactor.
2. Mercury contactor.
3. Toggle switches; one per step.
4. Step controller.
5. Time-delay relay.
6. Pilot lights; one per step.
7. Airflow proving switch.

J. Refer to Division 23 Section "Instrumentation and Control for HVAC" for thermostat.

K. Thermostats: 3-Stage Wall-mounted thermostats, with temperature range from 50 to 90 deg F (10 to plus 32 deg C), and 2.5 deg F (1.4 deg C) throttling range.

L. Capacities and Characteristics:

1. Coil Face Dimensions: As indicated on Drawings.
2. Mounting: Flanged.
3. Air Side:
   a. Flow Rate: 12,620 cfm.
   b. Face Velocity: 1100 fpm.
   c. Static Pressure Drop: 0.62 inches wg.
   d. Entering Temperature: 60 deg F.
   e. Leaving Temperature: 85 deg F.
4. Electrical Characteristics:
   a. Capacity: 80 kW.
   b. Number of Steps: SCR.
   c. Volts: 480.
   d. Phase: 3.
   e. Hertz: 60.
   f. Full-Load Amperes: 96.
   g. Minimum Circuit Ampacity: 125.
   h. Maximum Overcurrent Protection: 125.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Install stainless-steel drain pan under each cooling coil.

1. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1-2004.
2. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
3. Extend drain pan upstream and downstream from coil face.

4. Extend drain pan under coil headers and exposed supply piping.

D. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.

E. Straighten bent fins on air coils.

F. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section "Instrumentation and Control for HVAC," and other piping specialties are specified in Division 23 Section "Hydronic Piping."

D. Connect steam piping with gate valve and union and steam condensate piping with union, strainer, trap, and gate valve to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section "Instrumentation and Control for HVAC," and other piping specialties are specified in Division 23 Section "Steam and Condensate Heating Piping."

E. Connect refrigerant piping according to Division 23 Section "Refrigerant Piping."

F. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 82 16

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

1.6. INSPECTIONS

A. Contractor must secure a third party Electrical Inspector to certify all completed work. Contractor must submit inspector's inspection report prior to request for final payment.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with 2023 version of NFPA 70

B. Comply with NECA 1.

C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

F. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, or wireways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 00

SECTION 26 05 19 - 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. This Section includes the following:

1. Building wires and cables rated 600 V and less.

2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1. Division 26 Section "Control-Voltage Electrical Power Cables" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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 NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.
5. Rome Cable

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

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:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

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.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

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 and UL 486B.

B. Make splices 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 (150 mm) of slack.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

    a. Parking lot lighting

    b. Durasweeper

    c. Bus Wash

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 cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

    c. 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.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

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SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER 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. UTP cabling.
2. 50/125-micrometer, multimode optical fiber cabling.
3. Low-voltage control cabling.
4. Control-circuit conductors.
5. 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.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

C. Source quality-control reports.

D. Field quality-control reports.

E. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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.

1.6 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.
3. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP and optical fiber 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.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 5e cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.3 UTP 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. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, four-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM, Type CMG or Type CMP.
    b. Communications, Plenum Rated: Type CMP complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR complying with UL 1666.
    d. Multipurpose: Type MP or Type MPG.
    e. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    f. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP 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. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.

8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110 style for Category 5e. 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.

2.5 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. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

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/EIA-568-B.3 for performance specifications.
3. Comply with TIA/EIA-492AAAA-B 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 OFNG.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
    d. General Purpose, Conductive: Type OFC or Type OFCG.
    e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
    f. Riser Rated, Conductive: Type OFCR; complying with UL 1666.

5. Conductive cable shall be steel-armored type.
6. Maximum Attenuation: 3.5 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/EIA-598-B.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 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. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

B. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type SC 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.

2.7 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.8 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.9 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 UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Secure conduits to backboard if entering room from overhead.
3. Extend conduits 3 inches (75 mm) above finished floor.
4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.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.
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. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
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.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

E. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

F. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data 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 (305 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 (305 mm).

4. Separation between communications cables in grounded metallic raceways 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 (75 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. 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.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 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. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.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 after cross connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.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 meet or exceed applicable requirements in TIA/EIA-568-B.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/EIA-526-14-A, 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/EIA-568-B.1.

D. 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.

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 26 05 23

SECTION 26 05 26 - 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 systems and equipment.

1.3 SUBMITTALS

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

B. Qualification Data: For qualified testing agency and testing agency's field supervisor.

C. Field quality-control reports.

D. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS.

    a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
    b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently 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.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 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, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

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.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

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. 3/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 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. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

E. Metal and Wood 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.

3.3 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 (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole, and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. 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. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. 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.

F. 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.

G. 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 (18 m) apart.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.5 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**,** at ground test wells, 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.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of
tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

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 Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
3. Substations and Pad-Mounted Equipment: 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

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SECTION 26 05 29 - 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. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored 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 malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 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 Division 05 Section "Metal Fabrications" for steel shapes and plates.

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 except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. 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.

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, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in 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 (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY 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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. NBR: Acrylonitrile-butadiene rubber.

G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings.

B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

C. Qualification Data: For testing agency.

D. Source quality-control test reports.

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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: Steel set-screw type.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

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:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Type EPC-80-PVC, unless otherwise indicated.

C. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

D. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

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:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include 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.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

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. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

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:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

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. Armorcast Products Company.
b. Carson Industries LLC.

c. CDR Systems Corporation.
d. NewBasis.

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 a 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: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete or Fiberglass enclosures with polymer-concrete frame and cover, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Moderate Physical Damage: IMC. Includes raceways in the following locations:

    a. Gymnasium
    b. Bathrooms

3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

a. Mechanical, electrical, and plumbing utility rooms.
b. Kitchens

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: Rigid steel conduit.
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 Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) 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. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from RNC, Type EPC-80-PVC, to rigid steel conduit, before rising above the floor.

I. 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.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
   d. Attics: 135 deg F (75 deg C) temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

O. 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.

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 shown on plans.

2. Install backfill as shown on plans.
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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the 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 the 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 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 26 05 33

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SECTION 26 05 36 - CABLE TRAYS 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. This Section includes cable trays and accessories.

1.3 SUBMITTALS

A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
2. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.

    a. Design Calculations: Calculate requirements for selecting seismic restraints.
    b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

C. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements. Show the following:

1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to side of cable trays.
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

D. Field quality-control reports.

E. Operation and Maintenance Data: For cable trays to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

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 NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Aluminum and fiberglass cable tray may be stored outside without cover, but shall be loosely stacked, elevated off the ground, and ventilated to prevent staining during storage.

B. Steel cable tray shall be stored in a well-ventilated, dry location. Unpack and dry wet materials before storage.

C. Cable tray provided with painting or coating in field shall be stored indoors. Protect cable tray from scratching and marring of finish. Unpack and dry wet materials before storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chalfant Manufacturing Company.
2. Cooper B-Line, Inc.
3. Cope, T. J., Inc.; a subsidiary of Allied Tube & Conduit.
4. GS Metals Corp.; GLOBETRAY Products.
5. MONO-SYSTEMS, Inc.
6. MPHusky.
7. PW Industries.

2.2 MATERIALS AND FINISHES

A. Cable Trays, Fittings, and Accessories: Steel, complying with NEMA VE 1.

1. Factory-standard primer, ready for field painting; with cadmium-plated hardware according to ASTM B 766.
2. Mill galvanized before fabrication, complying with ASTM A 653/A 653M, G90 (Z275) coating; with hardware galvanized according to ASTM B 633.
3. Electrogalvanized before fabrication, complying with ASTM B 633; with hardware galvanized according to ASTM B 633.

4. Hot-dip galvanized after fabrication, complying with ASTM A 123/A 123M, Class B2; with Type 316 stainless-steel hardware.
5. PVC coating applied in a fluidized bed or by electrostatic spray; with Type 316 stainless-steel hardware.
6. Epoxy-resin paint over paint manufacturer's recommended primer and corrosion-inhibiting treatment; with Type 316 stainless-steel hardware.

B. Cable Trays, Fittings, and Accessories: Aluminum, complying with NEMA VE 1, Aluminum Association's Alloy 6063-T6 for rails, rungs, and cable trays, and Alloy 5052-H32 or Alloy 6061-T6 for fabricated parts; with Type 316 stainless-steel splice-plate fasteners, bolts, and screws

C. Cable Trays, Fittings, and Accessories: Stainless steel, Type 316, complying with NEMA VE 1.

D. Cable Trays, Fittings, and Accessories: Fiberglass, complying with NEMA FG 1 and UL 568. Splice-plate fasteners, bolts, and screws shall be fiberglass-encapsulated stainless steel. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation shall not be damaged when torqued to manufacturer's recommended value.

2.3 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Covers: Solid type of same materials and finishes as cable tray.

C. Barrier Strips: Same materials and finishes as cable tray.

D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.4 SOURCE QUALITY CONTROL

A. Perform design and production tests according to NEMA FG 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

B. Remove burrs and sharp edges from cable trays.

C. Fasten cable tray supports to building structure.
1. Place supports so that spans do not exceed maximum spans on schedules.
2. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
3. Support bus assembly to prevent twisting from eccentric loading.

4. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
5. Locate and install supports according to NEMA FG 1.

D. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.

E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA FG 1. Space connectors and set gaps according to applicable standard.

F. Make changes in direction and elevation using standard fittings.

G. Make cable tray connections using standard fittings.

H. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

I. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

J. Workspace: Install cable trays with enough space to permit access for installing cables.

K. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

L. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

3.2 CABLE INSTALLATION

A. Install cables only when cable tray installation has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

D. In existing construction, remove inactive or dead cables from cable tray.

E. Install covers after installation of cable is completed.

3.3 CONNECTIONS

A. Ground cable trays according to manufacturer's written instructions.

B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

3.4 FIELD QUALITY CONTROL

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

3.5 PROTECTION

A. Protect installed cable trays.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.
3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION 26 05 36

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SECTION 26 05 39 - UNDERFLOOR RACEWAYS 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. This Section includes the following:

1. Flat-top, single-channel, underfloor raceways.
2. Flat-top, multichannel, underfloor raceways.
3. Flush, flat-top underfloor raceways.
4. Cellular metal underfloor raceways.
5. Trench-type underfloor raceways.
6. Electrical connection components for precast concrete, hollow-core, floor decks.
7. Electrical connection components for electrified cellular steel floor decks.
8. Service fittings.

1.3 DEFINITIONS

A. Flush Outlet: Underfloor raceway outlet installed so the top of the fixed portions of the receptacles, jacks, and connector assemblies is located approximately at the surface of the floor or floor covering, and with the bodies of connected plugs exposed above the surface of the floor.

B. Flush Underfloor Raceway: Rectangular cross-section, flat-top raceway installed with the top of the raceway flush with the surface of the concrete in which it is embedded.

C. Header Raceway: Rectangular cross-section, single-channel or multichannel, underfloor raceway arranged as feeder raceway to bring wires and cables to service raceways from panelboards and communication terminal components.

D. Recessed Outlet: Underfloor raceway outlet installed with the top of the fixed portion of the connector assemblies located below the surface of the floor or floor covering and arranged to receive plug connectors with the bodies of the plugs concealed below the floor level.

E. Service Raceway: Underfloor distribution raceway providing direct connection to service fittings using preset or afterset inserts.

F. Trench Header: Trench-type raceway arranged as feeder raceway to bring wires and cables to service raceways from panelboards and communication terminal equipment.

G. Underfloor Raceway: A conduit, duct, or cell assembly, or trench located within the floor material or with its top at the floor surface.

1.4 SUBMITTALS

A. Product Data: For underfloor raceway components, fittings, and accessories.

B. Shop Drawings: For underfloor raceways. Include floor plans, assembly drawings, sections, and details.

1. Identify components and accessories such as expansion-joint assemblies, straight raceway lengths, preset and afterset inserts, and service fittings.
2. Provide dimensions locating raceway header and distribution elements. Include spacing between preset inserts and between preset inserts and ends of duct runs, walls, columns, junction boxes, and header duct connections.
3. Show connections between raceway elements and relationships between components and adjacent structural and architectural elements including slab reinforcement, floor finish work, permanent partitions[, architectural module lines] [, and pretensioning or post-tensioning components].
4. Indicate height of preset inserts, junction boxes, and raceways coordinated with depth of concrete slab and floor fill.
5. Indicate thickening of slabs where required for adequate encasement of raceway components.
6. Document coordination of exposed components with floor-covering materials to ensure that fittings and trim are suitable for indicated floor-covering material.
7. Revise locations from those indicated in the Contract Documents, as required to suit field conditions and to ensure a functioning layout. Identify proposed deviations from the Contract Documents.
8. Show details of connections and terminations of underfloor raceways at panelboards and communication terminal equipment in equipment rooms, wire closets, and similar spaces.

C. Samples: For typical underfloor raceway products, in specified finish, including the following:

1. Service fittings and flush and recessed outlet and junction-box covers.
2. A section of each service raceway configuration with specified preset insert and service fitting installed.
3. A junction box of each size and type for use with underfloor raceway.
4. A section of each header raceway configuration, complete with provisions for connection with service raceway.
5. A section of trench-type raceway, complete with cover and required trim.
6. A junction box of each size and type, complete with cover and trim.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For underfloor raceways, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:

1. Manufacturer's written instructions for locating preset inserts and for installing afterset inserts.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain underfloor raceway components for each system through one source from single manufacturer.

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.

PART 2 - PRODUCTS

2.1 FLAT-TOP, SINGLE-CHANNEL, UNDERFLOOR RACEWAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Square D; Schneider Electric.
2. Thomas & Betts Corporation; Steel City Division.
3. Walker Systems, Inc.; a Wiremold company.
4. Eaton; Tripp Lite..

B. Description:

1. Material: Steel.
2. Cross-Section Shape: Rectangular or Cylindrical.
3. Number of Levels: One.

2.2 JUNCTION BOXES

A. Description: Manufacturer's standard enclosure for indicated type, quantity, arrangement, and configuration of raceways at each raceway junction, intersection, and access location. Include the following accessories and features:

1. Mounting brackets.
2. Escutcheons and holders to accommodate surrounding floor covering.
3. Means for leveling and height adjustment more than 3/8 inch (10 mm) before and after concrete is placed.
4. Raceway Openings: For underfloor raceways and conduits arranged to accommodate raceway layout.
5. Covers shall have appropriate depth recess to receive specific floor finish material.
6. Partitions to separate wiring of different systems.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install raceways aligned and leveled and, unless otherwise indicated, parallel or perpendicular to building walls.

B. Arrange supports to attain proper elevation, alignment, and spacing of raceways. Install supports securely at ends and at intervals not to exceed 60 inches (1500 mm), to prevent movement during concrete pour.

C. Level raceway components with finished slab and make adjustments for floor finishes.

D. Remove burrs, sharp edges, dents, and mechanical defects.

E. Cap or plug boxes, insert- and service-fitting openings, and open ends of raceways.

F. Seal raceways to prevent water, concrete, or foreign matter from entering raceways before and during pouring slab or placing fill. Tape joints, or seal with compound, as recommended in writing by underfloor raceway manufacturer.

G. Junction Boxes: Install tops level and flush with finished floor. Install blank closure plates or plugs to close unused junction-box openings. Grout boxes in place to prevent movement during construction. Place top covers in inverted position during construction to prevent damage to surface of cover. Reinstall covers in proper position prior to final acceptance of Work.

H. Ground underfloor raceway components.

I. Level raceway components with finished slab and make adjustments in raceway component elevation to accommodate indicated floor finishes.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Perform visual inspection of interior of each junction box to verify absence of dirt, dust, construction debris, and moisture. Replace damaged and malfunctioning components.
2. Perform point-to-point tests of ground continuity and resistance of ground path between the most remote accessible fitting on each branch of each underfloor raceway system and the main electrical distribution grounding system.

a. Determine cause and perform correction of any point-to-point resistance value that exceeds 0.05 ohms.
b. Comply with NETA Acceptance Testing Specifications about safety, suitability of test equipment, test instrument calibration, and test report and records.

3.4 CLEANING

A. Clean and swab out underfloor raceways, inserts, and junction boxes after finish has been applied to floor slab, and remove foreign material, dirt, and moisture. Leave interiors clean and dry.

END OF SECTION 26 05 39

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SECTION 26 05 53 - 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 for conductors.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70 and 70E.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with SED Manual of Planning Standards section S815.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Description:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, 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.
2. Overall Thickness: 8 mils (0.2 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70, NFPA 70E, and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.6 INSTRUCTION SIGNS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. 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 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. 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 (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

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. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 12 inches (150 to 300 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

3.2 IDENTIFICATION SCHEDULE

A. 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 10-foot (3-m) maximum intervals.

B. 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.

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.
4) Neutral: White.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral: Gray.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) 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.

C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

D. 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 the Operation and Maintenance Manual.

E. 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 both direct-buried cables and cables in raceway.

F. 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.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the 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 systems unless equipment is provided with its own identification.

1. Labeling Instructions:

Indoor Equipment: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

a. Outdoor Equipment: Engraved.
b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
c. Unless provided with self-adhesive means of attachment, fasten labels 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 self-adhesive, engraved, laminated acrylic or melamine label.
b. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
c. Enclosed switches.
d. Enclosed circuit breakers.
e. Transfer switches.
f. Enclosed controllers.

g. Variable-speed controllers.
h. Contactors.
i. Monitoring and control equipment.
j. Emergency light fixtures.

END OF SECTION 26 05 53

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SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

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 computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals may be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:

B. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide Power*Tools Workbox by SKM Systems Analysis or a comparable product by one of the following:

1. Bentley Systems.
2. CGI CYME.
3. EDSA Micro Corporation.
4. ETAP Operation Technology, Inc.
5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus.
2. Distribution panelboard.
3. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

1. Transformers:

    a. ANSI C57.12.10.
    b. ANSI C57.12.22.
    c. ANSI C57.12.40.
    d. IEEE C57.12.00.
    e. IEEE C57.96.
2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
3. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 242 recommendations for fault currents and time intervals.

C. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

D. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

E. Completed data sheets for setting of overcurrent protective devices.

END OF SECTION 26 05 73

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SECTION 26 09 23 - 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. This Section includes the following lighting control devices:

1. Time switches.
2. Photoelectric switches.
3. Lighting contactors.
4. Occupancy and vacancy sensors.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, indoor occupancy sensors, and manual light switches.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls; a Genlyte Company.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Paragon Electric Co.; Invensys Climate Controls.
8. Square D; Schneider Electric.
9. TORK.
10. Touch-Plate, Inc.
11. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: SPST.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Programs: 1 channel; each channel shall be individually programmable with a minimum of 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
5. Internal photocell option.
6. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range**,** and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.

4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Grasslin Controls Corporation; a GE Industrial Systems Company.
6. Hubbell Lighting.
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. MicroLite Lighting Control Systems.
9. Square D; Schneider Electric.
10. TORK.
11. Touch-Plate, Inc.
12. Watt Stopper (The).

B. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.4 OCCUPANCY AND VACANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. GE Industrial Systems; Total Lighting Control.
3. Grasslin Controls Corporation; a GE Industrial Systems Company.
4. Sensorswitch; Acuity Lighting Group, Inc.
5. Sensorworx; BLP Technologies.
6. Square D; Schneider Electric.
7. Touch-Plate, Inc.
8. Watt Stopper (The).

B. Description: Dual-technology type, Passive Infra-Red and Ultrasonic or Passive Infra-Red and Acoustical. Unitary enclosure or integrated with other switching devices and contractors.

1. Passive Infra-Red: Capable of observing occupants within 15 feet, measured horizontally from a point on the floor directly below the sensor.
2. Ultrasonic: 40 kHz frequency, compliant with TIA guidelines to prevent signal interference with other systems.
3. Field-programmable sensitivity and time delay settings.
4. Enclosure: Comply with NEMA 250.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "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 Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to four visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 09 23

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SECTION 26 12 00 - MEDIUM-VOLTAGE DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. The requirements of this section shall apply to overhead and underground distribution of medium-voltage equipment.

B. Submittals

1. Product Data: For medium-voltage cables, cable splice equipment.
2. Product Data: For medium-voltage transformers.

C. Source Limitations: Obtain cables and accessories through one source from a single manufacturer.

D. Comply with NFPA 70.

E. Provide concrete bases for pad-mounted transformers.

F. Consult with the serving utility company for installation. The serving utility company is ORANGE AND ROCKLAND UTILITIES.

PART 2 - PRODUCTS

2.1 CABLES

A. Shall be in accordance with the requirements of the serving utility company.

2.2 CABLE SPLICE KITS

A. Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for application.

2.3 DISTRIBUTION TRANSFORMERS

A. Liquid-Filled pad-mounted, distribution transformers.

1. Liquid shall be oil of a less flammable type; Fire point not less than 300 deg C.

B. “Delta Primary / Wye Secondary” winding configuration, unless noted otherwise.

C. Windings: Copper.

D. Enclosure: Ventilated, NEMA 250, Type 4X.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

1. Install cables parallel and perpendicular to building lines.
2. Install cable splices at locations where shown or required; use standard kits according to manufacturer’s instruction.
3. Apply arc-proofing at all exposed locations.
4. Seal around penetrations through walls according to Division 07 Section “Penetration Firestopping.”

B. Install transformers on concrete bases.

C. Maintain minimum clearances and workspace at equipment according to NFPA 70.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section "Common Work Results for Electrical."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 26 12 00

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

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 types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For testing agency.

D. Source quality-control test reports.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

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. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Products.
2. General Electric Company.
3. Siemens Energy & Automation, Inc.
4. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Windings: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20 and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

G. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

H. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

I. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.
3. Shield Effectiveness:

a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

J. Fungus Proofing: Permanent fungicidal treatment for coil and core.

K. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.4 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

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SECTION 26 24 13 - SWITCHBOARDS

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 and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.

5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

D. Qualification Data: For qualified testing agency.

E. 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.

F. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NECA 400.

1.7 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards 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 104 deg F (40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

C. 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 Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager’s and Owner’s written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of switchboards 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. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 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. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
5. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Nominal System Voltage: As shown on Drawings.

D. Main-Bus Continuous: As shown on Drawings for each Switchgear.

E. Indoor Enclosures: Steel, NEMA 250, Type 1.

F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

G. Barriers: Between adjacent switchboard sections.

H. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

I. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

J. Hinged Front Panels: Allow access to circuit breaker, accessory, and blank compartments.

K. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.

2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

L. Buses and Connections: Three phase, four wire unless otherwise indicated.
1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, or tin-plated, high-strength, electrical-grade aluminum alloy.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with compression connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

M. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

N. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

O. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

B. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

C. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

D. Protection modes and UL 1449 SVR for grounded wye circuits with three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277, 400 V for 208Y/120.
2. Line to Ground: 800 V for 480Y/277, 400 V for 208Y/120.
3. Neutral to Ground: 800 V for 480Y/277, 400 V for 208Y/120.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.

    b. Lugs: compression style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    g. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Drawout circuit-breaker mounting.
2. Two-step, stored-energy closing.
3. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time time adjustments.
    c. Ground-fault pickup level, time delay, and I^2t response.

4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
5. Remote trip indication and control.
6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

8. Control Voltage: 40Vdc.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

2.5 IDENTIFICATION

A. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

B. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-In-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
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 switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Division 26 Section "Low Voltage Electrical Power Conductors and Cables." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Division 26 Section "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.5 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 inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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 switchboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
   c. 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.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 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.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

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SECTION 26 24 16 - 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. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. 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. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Qualification Data: For qualified testing agency.

D. 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.

E. Circuit Directory: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

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 NEMA PB 1.

E. Comply with NFPA 70.

1.6 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 NECA 407.

1.7 PROJECT 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. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

C. 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 Construction Manager and Owner no fewer than two days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without Construction Manager's and Owner's written permission.

3. Comply with NFPA 70E.

1.8 COORDINATION

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.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 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. Keys: Two spares for each type of panelboard cabinet lock.

2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted 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. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finishes:

   a. Panels and Trim: Steel and galvanized 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.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or main lugs only (See drawings).

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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. ABB Electric; General Electric Company.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

4. Shunt-Trip Devices: 12 Volt or 24 Volt DC coil.

2.4 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. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "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. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Acceptance Testing Preparation:

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 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 panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. 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. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

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SECTION 26 27 26 - 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. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Isolated-ground receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Ceiling mounted occupancy sensors.
6. Communications outlets.
7. Pendant cord reel devices.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

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 NFPA 70.

1.6 COORDINATION

A. Receptacles for Equipment Furnished by Others: Match plug configurations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Hubbell; CR 5253IG.
b. Leviton; 5362-IG.

c. Pass & Seymour; IG6300.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 PENDANT CORD REEL DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. 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.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Single-Pole Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but not limited to, the following:
   a. Cooper; 1995
   b. Hubbell; HBL 1557
   c. Leviton; 1257
   d. Pass & Seymour; 1251

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 OCCUPANCY SENSORS

A. As specified in Division 26 section “Lighting Control Devices”, where installed in shared enclosure with wiring devices.

2.8 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 3560-6.
   b. Leviton; 40649.

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

2.9 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant , die-cast aluminum with lockable cover.

2.10 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. 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 the boxes.
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 just 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.

D. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
3. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
5. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. Tighten unused terminal screws on the device.
8. 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:

1. Install dimmers within terms of their listing.
2. 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.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED 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 not acceptable.
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. The 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.

END OF SECTION 26 27 26

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SECTION 26 28 13 - 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 control circuits and enclosed switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, and descriptions of individual components. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

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.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

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, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

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, fast acting.
2. Feeders: Class L, fast acting.
3. Motor Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

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SECTION 26 28 16 - 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 SUBMITTALS

A. Product Data: For each type of enclosed switch, 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.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Qualification Data: For qualified testing agency.

C. 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.

D. Operation and Maintenance Data: For enclosed switches and to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

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.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

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 Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's and Owner's written permission.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 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. 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.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600V ac: 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. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Compression type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac: 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. Lugs: Compression type, suitable for number, size, and conductor material.

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 3R.
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 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 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.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. 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. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. 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.

E. Enclosed switches will be considered defective if they do not pass tests and inspections.

F. 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.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 28 16

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SECTION 26 29 23 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

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 separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

B. Related Sections:

1. Division 26 Section "Motor-Control Centers" for VFCs installed in motor-control centers.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformite Europeene (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCP: Motor-circuit protector.

I. NC: Normally closed.

J. NO: Normally open.

K. OCPD: Overcurrent protective device.

L. PCC: Point of common coupling.

M. PID: Control action, proportional plus integral plus derivative.

N. PWM: Pulse-width modulated.

O. RFI: Radio-frequency interference.

P. TDD: Total demand (harmonic current) distortion.

Q. THD(V): Total harmonic voltage demand.

R. VFC: Variable-frequency motor controller.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

1.5 SUBMITTALS

A. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.

C. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of enclosed unit.
f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
g. Specified modifications.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

D. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

E. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

F. Qualification Data: For qualified testing agency.

G. Seismic Qualification Certificates: For VFCs, 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.

H. Product Certificates: For each VFC, from manufacturer.

I. Source quality-control reports.

J. Field quality-control reports.

K. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

L. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.

M. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently 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 NFPA 70.

D. IEEE Compliance: Fabricate and test VFC according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

1.7 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).
2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
3. Humidity: Less than 95 percent (noncondensing).
4. Altitude: Not exceeding 3300 feet (1005 m).

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.9 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.
2. Ratings and characteristics of supply circuit and required control sequence.
3. Ambient and environmental conditions of installation location.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Mechanical Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Rockwell Automation, Inc.; Allen-Bradley Brand.
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric.

C. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

D. Application: Constant torque and variable torque.

E. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

F. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

G. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

H. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 5 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 97 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 22kA.
7. Ambient Temperature Rating: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).
8. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
9. Humidity Rating: Less than 95 percent (noncondensing).
10. Altitude Rating: Not exceeding 3300 feet (1005 m).
11. Vibration Withstand: Comply with IEC 60068-2-6.
12. Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
14. Speed Regulation: Plus or minus 10 percent.
15. Output Carrier Frequency: Selectable; 0.5 to 15kHz.
16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

I. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

J. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.
2. Signal: Pneumatic.

K. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

L. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.

9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor overtemperature fault.

M. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

N. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

O. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

P. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

Q. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

R. Integral Input Disconnecting Means and OCPD: NEMA AB 1, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
3. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
5. NC alarm contact that operates only when circuit breaker has tripped.

2.2 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

a. A minimum of two programmable analog inputs: 0- to 10-V dc.
b. A minimum of six multifunction programmable digital inputs.

2. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).
3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

a. 0- to 10-V dc.
b. 4- to 20-mA dc.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs.

4. Output Signal Interface: A minimum of one programmable analog output signal(s) 0- to 10-V dc, which can be configured for any of the following:

a. Output frequency (Hz).
b. Output current (load).
c. DC-link voltage (V dc).
d. Motor torque (percent).
e. Motor speed (rpm).
f. Set point frequency (Hz).

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Number of Loops: One.

G. BMS Interface: Factory-installed hardware and software to enable the BMS to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.
2. Embedded BMS Protocols for Network Communications: LonWorks protocols accessible via the communications ports.

2.3 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of all VFCs to less than 8 percent and THD(V) to 5 percent.

2.4 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 12.
2. Outdoor Locations: Type 3R.
3. Other Wet or Damp Indoor Locations: Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.5 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, oiltight type.

a. Push Buttons: Covered types; maintained.
b. Pilot Lights: LED, Green; Push to test.
c. Selector Switches: Rotary type.
d. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

B. NC bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

E. Supplemental Digital Meters:

1. Elapsed-time meter.
2. Kilowatt meter.
3. Kilowatt-hour meter.

F. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 3R Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

H. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

I. Spare control-wiring terminal blocks; unwired.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HARMONIC ANALYSIS STUDY

A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

B. Prepare a harmonic analysis study and report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.3 INSTALLATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

C. Floor-Mounting Controllers: Install VFCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
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.

D. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

1. Curbs and roof penetrations are specified in Division 07 Section "Roof Accessories."
2. Structural-steel channels are specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. Install fuses in each fusible-switch VFC.

H. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

I. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

J. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

K. Comply with NECA 1.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Division 26 Section "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 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 inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) 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 VFC. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.
    c. 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.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFCs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

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.

3.8 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges.

F. Set field-adjustable pressure switches.

3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

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

END OF SECTION 26 29 23

SECTION 26 32 13 - 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. This Section includes packaged engine-generator sets for standby power supply with the following features:

1. Gas engine.
2. Unit mounted control and monitoring.
3. Performance requirements for sensitive loads.
4. Load banks.
5. Outdoor enclosure.

B. Generator system shall be in accordance with NFPA 110, Class X, Type M, Level 2.

C. Related Sections include the following:

1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

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.

B. LP: Liquid petroleum.

1.4 SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

4. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For installer, manufacturer, and testing agency.

E. Source quality-control test reports.

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. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. 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.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. 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.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level [1] [2] emergency power supply system.

K. Comply with UL 2200.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with 50 dB for maximum noise level at all entrances to existing and new buildings due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 4 to 104 degree F (-15 to 40 degrees C) .
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

1.7 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Division 07 Section "Roof Accessories."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product shown on drawings or a comparable product by one of the following:

1. Caterpillar; Engine Div.
2. Generac Power Systems, Inc.
3. Kohler Co.; Generator Division.
4. Magnetek, Inc.
5. Onan/Cummins Power Generation; Industrial Business Group.
6. Spectrum Detroit Diesel.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. 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.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Natural gas .

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:
   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.

E. Engine Fuel System:

   1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
   2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
   3. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:

      a. Carburetor.
      b. Secondary Gas Regulators: One for each fuel type.
      c. Fuel-Shutoff Solenoid Valves: One for each fuel source.
      d. Flexible Fuel Connectors: One for each fuel source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: mechanical.

H. Muffler/Silencer: Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

   1. Minimum sound attenuation of 18 dB at 500 Hz.
   2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 70 dBA or less.

I. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

J. Starting System: 12 or 24-VDC electric, with negative ground.

   1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
   2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
   3. Cranking Cycle: 60 seconds.

4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" 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 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. 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 deg C to plus 60 deg C 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.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 CONTROL AND MONITORING

A. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. 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 generator set. Mounting method shall isolate the control panel from generator-set vibration.

C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 2 system, and the following:
    1. AC voltmeter.
    2. AC ammeter.
    3. AC frequency meter.
    4. DC voltmeter (alternator battery charging).

5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

D. 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.

E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Division 26 Section "Electrical Power Monitoring and Control."

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. 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 generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

1. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
2. 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 generator set.
3. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.6 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 or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. 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.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.7 LOAD BANK

A. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive unit capable of providing a balanced 3-phase, delta-connected load to generator set at 100 percent rated-system capacity, at 80 percent power factor, lagging. Unit may be composed of separate resistive and reactive load banks controlled by a common control panel. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.

B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases.

C. Reactive Load Elements: Epoxy-encapsulated reactor coils.

D. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.

E. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.

F. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.

G. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow

shall be screened with 1/2-inch- (13-mm-) square, galvanized-steel mesh. Reactive load bank shall include automatic shutters at air intake and discharge.

H. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000-A interrupting capacity.

I. Remote-Control Panel: Separate from load bank in NEMA 250, Type 1 enclosure with a control power switch and pilot light, and switches controlling groups of load elements.

J. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or preengineered walk-in enclosure with the following features:

1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
4. Hinged Doors: With padlocking provisions.
5. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
7. Muffler Location: within enclosure.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

D. Convenience Outlets: Factory wired ground fault interrupting. Arrange for external electrical connection.

2.9 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

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. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set 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. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. 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 of 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 packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with vibration isolation having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel and exhaust-system piping adjacent to packaged engine generator to allow 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.

1. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-Gas Piping."

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

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.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. 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.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. 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.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). 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.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. 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.
9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at each entrance to new and existing buildings and compare measured levels with required values.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove and replace malfunctioning units and retest as specified above.

K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

L. 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.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 32 13

SECTION 26 36 00 - 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. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Nonautomatic transfer switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For manufacturer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain all transfer switches and componetns through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AC Data Systems, Inc.
2. ASCO Power Technologies; Schneider Electric.
3. Caterpillar; Engine Div.
4. Generac Power Systems, Inc.
5. GE Zenith Controls.
6. Kohler Power Systems; Generator Division.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. 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.

B. Tested Fault-Current Closing and Withstand 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. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. 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 not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

F. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "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.

I. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 NONAUTOMATIC TRANSFER SWITCHES

A. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

B. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.

C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.

D. Nonautomatic Transfer-Switch Accessories:

1. Pilot Lights: Indicate source to which load is connected.
2. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternate-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."

3. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

D. Identify components according to Division 26 Section "Identification for Electrical Systems."

E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
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. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test 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. 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.

4. After energizing circuits, 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 of 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.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
g. 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.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

E. Coordinate tests with tests of generator and run them concurrently.

F. 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.

G. Remove and replace malfunctioning units and retest as specified above.

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 as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

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SECTION 26 43 13 - TRANSIENT-VOLTAGE SUPPRESSION 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 TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Qualification Data: For qualified testing agency.

C. Product Certificates: For TVSS devices, from manufacturer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

D. Comply with NEMA LS 1.

E. Comply with UL 1283 and UL 1449.

F. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.

2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).

3. Humidity: 0 to 85 percent, noncondensing.

4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.7 COORDINATION

A. Coordinate location of field-mounted TVSS devices to allow adequate clearances for maintenance.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

1.9 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. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

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. ABB USA.
2. AC Data Solutions.
3. Advanced Protection Technologies Inc. (APT).
4. Atlantic Scientific.
5. Current Technology Inc.; Danaher Power Solutions.
6. Danaher Power Solutions; United Power Products.
7. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
8. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
9. Intermatic, Inc.
10. LEA International.
11. Leviton Mfg. Company Inc.
12. Liebert Corporation; a division of Emerson Network Power.
13. Northern Technologies, Inc.; a division of Emerson Network Power.
14. Siemens Energy & Automation, Inc.
15. Square D; a brand of Schneider Electric.
16. Surge Suppression Incorporated.

B. Surge Protection Devices:

1. Comply with UL 1449.
2. Modular design (with field-replaceable modules).
3. Fuses, rated at 200-kA interrupting capacity.
4. Fabrication using bolted compression lugs for internal wiring.
5. Redundant suppression circuits.
6. Redundant replaceable modules.
7. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
8. LED indicator lights for power and protection status.
9. Audible alarm, with silencing switch, to indicate when protection has failed.
10. 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.
11. Four-digit transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 320 kA per mode/640 kA per phase.

D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2

1. Line to Neutral: 70,000 A.
2. Line to Ground: 70,000 A.

3. Neutral to Ground: 50,000 A.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 400 V for 480Y/277 V
2. Line to Ground: 400 V for 480Y/277 V
3. Neutral to Ground: 400 V for 480Y/277 V

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup checks according to manufacturer's written instructions.

C. TVSS device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Do not energize or connect service entrance equipment and panelboards to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

END OF SECTION 26 43 13

SECTION 26 51 00 - 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 lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. RELATED SECTIONS:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for compact fluorescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Installation instructions.

C. 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. Lighting fixtures.
2. Suspended ceiling components.
3. Structural members to which suspension systems for lighting fixtures will be attached.
4. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Smoke and fire detectors.
    c. Occupancy sensors.
    d. Access panels.

5. Perimeter moldings.

D. Field quality-control reports.

E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

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 NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

1.8 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. Luminaires: 1 for every 10 of each type installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. 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.

E. Diffusers:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
    b. UV stabilized.

F. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles.

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.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance free, lead-acid type to provide 90 minutes of continuous back-up power in the event of a power outage Charger: Fully automatic, solid-state type with sealed transfer relay.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
4. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
6. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LED LIGHTING FIXTURES

A. General requirements for LED lighting fixtures:

1. Comply with UL 1598 and UL 8750.
2. Housing, driver, and module shall be products of the same manufacturer.

B. Dimming: Fixtures with dimmable drivers shall have leads for #12 AWG 0-10V dimming wires.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.

B. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

4. Install four independent support rods or wires from structure to a tab on lighting fixture (one in each corner). Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. 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.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

END OF SECTION 26 51 00

SECTION 26 56 00 - 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 luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.4 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.

4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
8. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

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. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.

D. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

E. Field quality-control reports.

F. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

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 IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on drawings

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. 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. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. 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.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected from manufacturer's standard catalog of colors.

N. 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; 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.

O. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Adjust luminaires that require field adjustment or aiming. Include adjustement of photosensing control device to prevent false operation by artificial light sources.

3.2 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 Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
d. IESNA LM-64, "Photometric Measurements of Parking Areas."
e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. 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.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 26 56 00

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 27 05 00

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for cabling associated with system panels.
2. Division 27 Section "Communications Horizontal Cabling" for cabling associated with devices.
3. Division 28 Section "Conductors and Cables for Electronic Safety and Security" cabling associated with electronic safety and security.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For floor-mounted cabinets, 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. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD/NTS.

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. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.8 COORDINATION

A. Owner, installer, and all equipment vendors shall coordinate layout and installation of communications equipment room.

1. Meet jointly to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of all equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cable Management Solutions, Inc.
   b. Cablofil Inc.
   c. Cooper B-Line, Inc.
   d. Cope - Tyco/Allied Tube & Conduit.
   e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

   a. Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
   b. Trough Cable Trays: Nominally 6 inches (150 mm) wide.
   c. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
   d. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
   e. Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with solid covers.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems. Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated,3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products as specified by system vendors or by one of the following:

1. ADC.
2. Cooper B-Line, Inc.
3. Hubbell Premise Wiring.
4. Leviton Voice & Data Division.
5. Middle Atlantic Products, Inc.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Ortronics, Inc.
8. Siemon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and power strip.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Integrated fan with filter.
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Integrated fan with filter.
9. Power strip.
10. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Rack mounting.
2. Six 15-A, 120-VAC, NEMA 5-15R receptacles.

3. LED indicator lights for power and protection status.
4. LED indicator lights for reverse polarity and open outlet ground.
5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
6. Connected 15-foot (4.5-m) line cord.
7. Rocker-type on-off switch, illuminated when in on position.
8. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
9. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems.

B. Comply with NECA 1.

C. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

D. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

E. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.3 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

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 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.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section.Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration.

C. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 11 00

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SECTION 27 13 00 - COMMUNICATIONS 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. Pathways.
2. UTP cable.
3. Optical fiber cabling.
4. Coaxial cable.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Cabling identification products.

B. Related Sections:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

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. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. 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 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

    a. Nominal OD.
    b. Minimum bending radius.
    c. Maximum pulling tension.

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.
6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

    a. Vertical and horizontal offsets and transitions.
    b. Clearances for access above and to side of cable trays.
    c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 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.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, 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: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

D. 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.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.8 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 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.
3. Test each pair of UTP cable for open and short circuits.

1.9 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.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.11 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. Patch-Panel Units: One of each type.
2. Connecting Blocks: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.

7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG.
    b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX.
    e. Multipurpose: Type MP or MPG.
    f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. 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.

D. 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.

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

G. Patch Cords: Factory-made, four-pair cables in 36-inch (900 mm)48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

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/EIA-568-B.3 for performance specifications.

3. Comply with TIA/EIA-492AAAA-B 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 OFNG.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
    d. General Purpose, Conductive: Type OFC or OFCG.
    e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
    f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.

5. Conductive cable shall be steel 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/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

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 (900-mm) lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Belden CDT Inc.; Electronics Division.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka USA.

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG59/U: NFPA 70, Type CATVR.

1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
4. Color-coded PVC jacket.

E. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

F. RG59/U: NFPA 70, Type CATV.

1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
3. PVC jacket.

G. RG59/U (Plenum Rated): NFPA 70, Type CMP.

1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
3. Copolymer jacket.

H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aim Electronics; a brand of Emerson Electric Co.
2. Leviton Voice & Data Division.
3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.10 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. 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. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical 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 PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (76 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. 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.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
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 ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. 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.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable 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.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

G. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

H. Group connecting hardware for cables into separate logical fields.

I. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data 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 (610 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 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 (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).

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

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 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.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section..

D. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

E. 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.

F. 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, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

G. 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 terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    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.

H. 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/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 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. Visually inspect UTP and 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/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper 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/EIA-568-B.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 meet or exceed applicable requirements in TIA/EIA-568-B.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 1 direction according to TIA/EIA-526-14-A, 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 that calculated according to equation in TIA/EIA-568-B.1.

D. 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.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 27 13 00

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SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL ARCHITECT

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. Pathways.
2. UTP cabling.
3. [50/125] [62.5/125]-micrometer, optical fiber cabling.
4. Coaxial cable.
5. Multiuser telecommunications outlet assemblies.
6. Cable connecting hardware, patch panels, and cross-connects.
7. Telecommunications outlet/connectors.
8. Cabling system identification products.
9. Cable management system.

B. Related Sections:
1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.

D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

G. IDC: Insulation displacement connector.

H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

I. LAN: Local area network.

J. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

L. RCDD: Registered Communications Distribution Designer.

M. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.

N. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.

O. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors 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. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

2. Fiber optic cable, for each type used.

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.
6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

a. Vertical and horizontal offsets and transitions.
b. Clearances for access above and to side of cable trays.
c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration.

D. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance Data: For splices and connectors to include in maintenance manuals.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.
4. Printout of software application and graphic screens.

1.7 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.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, 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: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

D. 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.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cables to determine the continuity of the strand end to end. Use [optical fiber flashlight] [or] [optical loss test set] <Insert test>.
2. Test optical fiber cables 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.
3. Test each pair of UTP cable for open and short circuits.

1.9 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.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and 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.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 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. Patch-Panel Units: One of each type.
2. Connecting Blocks: One of each type.
3. Device Plates: One of each type.
4. Multiuser Telecommunications Outlet Assemblies: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cable Management Solutions, Inc.
   b. Cablofil Inc.
   c. Cooper B-Line, Inc.
   d. Cope - Tyco/Allied Tube & Conduit.
   e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

   a. Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
   b. Trough Cable Trays: Nominally 6 inches (150 mm) wide.
   c. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
   d. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
   e. Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with solid covers.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems. Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated,3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.

8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG.
    b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX.
    e. Multipurpose: Type MP or MPG.
    f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. 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.

D. 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.

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

G. Patch Cords: Factory-made, four-pair cables in 36-inch (900 mm)48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

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/EIA-568-B.3 for performance specifications.
3. Comply with TIA/EIA-492AAAA-B 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 OFNG.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
    d. General Purpose, Conductive: Type OFC or OFCG.
    e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
    f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.

5. Conductive cable shall be steel 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/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

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 (900-mm) lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.

2. Belden CDT Inc.; Electronics Division.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka USA.

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG59/U: NFPA 70, Type CATVR.

1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
4. Color-coded PVC jacket.

E. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

F. RG59/U: NFPA 70, Type CATV.

1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
3. PVC jacket.

G. RG59/U (Plenum Rated): NFPA 70, Type CMP.

1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
3. Copolymer jacket.

H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aim Electronics; a brand of Emerson Electric Co.
2. Leviton Voice & Data Division.
3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 CONSOLIDATION POINTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Chatsworth Products, Inc.
3. Dynacom Corporation.
4. Hubbell Premise Wiring.
5. Molex Premise Networks; a division of Molex, Inc.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Ortronics, Inc.
8. Panduit Corp.
9. Siemon Co. (The).

B. Description: Consolidation points shall comply with requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field:

    a. One for each four-pair UTP cable indicated.
    b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.

3. Mounting: Recessed in ceiling.
4. NRTL listed as complying with UL 50 and UL 1863.
5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.10 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chatsworth Products, Inc.
2. Hubbell Premise Wiring.
3. Molex Premise Networks; a division of Molex, Inc.
4. Nordex/CDT; a subsidiary of Cable Design Technologies.
5. Ortronics, Inc.
6. Panduit Corp.
7. Siemon Co. (The).

B. Description: MUTOAs shall meet the requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field:

    a. One for each four-pair UTP cable indicated.
    b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.

3. Mounting: Furniture.
4. NRTL listed as complying with UL 50 and UL 1863.
5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.11 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Two-port-connector assemblies mounted in [multigang] faceplate.

1. Faceplate: In accordance with Division 26 Section “Wiring Devices”
2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

3. Legend: Factory labeled by silk-screening or engraving.
4. Legend: Machine printed, in the field, using adhesive-tape label.
5. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.12 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.13 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.14 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. 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 raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical 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 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 PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 2 inches (51 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. MUTOA shall not be used as a cross-connect point.
5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

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 UTP at least 49 feet (15 m) from communications equipment room.

6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
7. 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.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
10. 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.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable 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.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

G. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

H. Group connecting hardware for cables into separate logical fields.

I. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data 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 (610 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 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 (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).

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

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 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.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: 3.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration.

E. Cable Schedule: Post in 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.

F. 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, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses

and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

G. 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 terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    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.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

H. 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/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 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. Visually inspect UTP and optical fiber cable 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/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test UTP backbone copper 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/EIA-568-B.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.

5. Optical Fiber Cable Tests:

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.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 1 direction according to TIA/EIA-526-14-A, 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 that calculated according to equation in TIA/EIA-568-B.1.

6. UTP Performance Tests:

    a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

        1) Wire map.
        2) Length (physical vs. electrical, and length requirements).
        3) Insertion loss.
        4) Near-end crosstalk (NEXT) loss.
        5) Power sum near-end crosstalk (PSNEXT) loss.
        6) Equal-level far-end crosstalk (ELFEXT).
        7) Power sum equal-level far-end crosstalk (PSELFEXT).
        8) Return loss.
        9) Propagation delay.
        10) Delay skew.

7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
8. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System."
9. Final Verification Tests: Perform verification tests for UTP[and optical fiber] systems after the complete communications cabling and workstation outlet/connectors are installed.

    a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and

listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.

b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. 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.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets

END OF SECTION 27 15 00

SECTION 27 511 6 - PUBLIC ADDRESS AND MASS NOTIFICATION 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. Preamplifiers.
2. Power amplifiers.
3. Transfer to standby amplifier.
4. Microphones.
5. Volume limiter/compressors.
6. Control console.
7. Equipment cabinet.
8. Equipment rack.
9. Tone generator.
10. Monitor panel.
11. Loudspeakers.
12. Noise-operated gain controllers.
13. Microphone and headphone outlets.
14. Conductors and cables.
15. Raceways.

1.3 DEFINITIONS

A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

B. VU: Volume unit.

C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

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

B. Shop Drawings: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
2. Console layouts.
3. Control panels.
4. Rack arrangements.

5. Wiring Diagrams: For power, signal, and control wiring.

a. Identify terminals to facilitate installation, operation, and maintenance.
b. Single-line diagram showing interconnection of components.
c. Cabling diagram showing cable routing.

C. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components 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 supports and seismic restraints for control consoles, equipment cabinets and racks, and components.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

E. Qualification Data: For qualified installer.

F. Seismic Qualification Certificates: For control consoles, equipment cabinets and racks, 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.

G. Field quality-control reports.

H. Operation and Maintenance Data: For public address and mass notification systems to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Personnel certified by NICET as Audio Systems Level III Technician.

B. Source Limitations: Obtain public address and mass notification systems from single source from single manufacturer.

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.

1.7 COORDINATION

A. Coordinate layout and installation of system components 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.

1.8 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. Microphone: One.
2. Desk Stand(s): One.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:

1. Selectively connect any zone to any available signal channel.
2. Selectively control sound from microphone outlets and other inputs.
3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.

4. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
5. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with TIA/EIA-310-D.

D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.4 PREAMPLIFIERS

A. Preamplifier: Separately mounted.

B. Preamplifier: Integral to power amplifier.

C. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.

D. Total Harmonic Distortion: Less than 1 percent.

E. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.

F. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.

G. Minimum Noise Level: Minus 55 dB below rated output.

H. Controls: On-off, input levels, and master gain.

2.5 POWER AMPLIFIERS

A. Mounting: Console or Rack.

B. Output Power: 70-V balanced line. 100 percent of the sum wattage of connected loads for each station and speaker connected in all-call mode of operation.

C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

D. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

E. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

F. Output Regulation: Less than 2 dB from full to no load.

G. Controls: On-off, input levels, and low-cut filter.

H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.6 TRANSFER TO STANDBY AMPLIFIER

A. Monitoring Circuit and Sensing Relay: Detect reduction in output of power amplifier of 40 percent or more and, in such event, transfer load and signal automatically to standby amplifier.

2.7 MICROPHONES

A. Paging Microphone:

1. Type: Dynamic.
2. Frequency Response: Uniform, 50 to 14,000 Hz.
3. Output Level: Minus 58 dB, minimum.
4. Finish: Satin chrome.
5. Cable: C25J.
6. Mounting: Desk stand with integral-locking, press-to-talk switch.

2.8 VOLUME LIMITER/COMPRESSOR

A. Minimum Performance Requirements:

1. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
2. Signal Reduction Ratio: At least a 10:1 and 5:1 selectable capability.
3. Distortion: 1 percent, maximum.
4. Rated Output: Minimum of plus 14 dB.
5. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
6. Rack mounting.

2.9 CONTROL CONSOLE

A. Cabinet: Modular, desktop; complying with TIA/EIA-310-D.

B. Housing: Steel, 0.0478 inch (1.2 mm) minimum, with removable front and rear panels. Side panels are removable for interconnecting side-by-side mounting.

C. Panel for Equipment and Controls: Rack mounted.

D. Controls:

1. Switching devices to select signal sources for distribution channels.
2. Program selector switch to select source for each program channel.
3. Switching devices to select zones for paging.
4. All-call selector switch.

E. Indicators: A visual annunciation for each distribution channel to indicate source being used.

F. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.

G. Spare Positions: 20 percent spare zone control and annunciation positions on console.

H. Microphone jack.

2.10 EQUIPMENT CABINET

A. Comply with TIA/EIA-310-D.

B. House amplifiers and auxiliary equipment at each location.

C. Cabinet Housing:

1. Constructed of 0.0478-inch (1.2-mm) steel, minimum, with front- and rear-locking doors and standard TIA/EIA-310-D-compliant, 19-inch (483-mm) racks.
2. Arranged for floor or wall mounting as indicated.
3. Sized to house all equipment indicated, plus spare capacity.
4. Include 20 percent minimum spare capacity for future equipment in addition to space required for future cassette deck and CD player.

D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.

E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.

2.11 EQUIPMENT RACK

A. Racks: 19 inches (483 mm) standard, complying with TIA/EIA-310-D.

B. Power-Supply Connections: Compatible plugs and receptacles.

C. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.

D. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.

E. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.

F. Service Light: At top rear of rack with an adjacent control switch.

G. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c.; the full height of rack.

H. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.

I. Spare Capacity: 20 percent in rack for future equipment.

2.12 TELEPHONE PAGING ADAPTER

A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.

1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
2. Impedance Matching: Adapter matches telephone line to public address equipment input.
3. Rack mounting.

2.13 TONE GENERATOR

A. Generator shall provide clock and program interface with public address and mass notification system.

B. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.

C. Pitch Control: Chimes and tone.

D. Volume Control: All outputs.

E. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.

F. Mounting: Rack.

2.14 MONITOR PANEL

A. Monitor power amplifiers.

B. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.

C. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.

D. Mounting: Rack.

2.15 LOUDSPEAKERS

A. Cone-Type Loudspeakers:

1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
3. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
4. Minimum Dispersion Angle: 100 degrees.
5. Rated Output Level: 10 W.
6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.

7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.
8. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.

B. Horn-Type Loudspeakers:

1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
4. Dispersion Angle: 130 by 110 degrees.
5. Mounting: Integral bracket.
6. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.

2.16 NOISE-OPERATED GAIN CONTROLLER

A. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.

B. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.

C. Level Adjustment Range: 20 dB minimum.

D. Maximum Distortion: 1 percent.

E. Control: Permits adjustment of sensing level of device.

2.17 CONDUCTORS AND CABLES

A. Jacketed, twisted pair and twisted multipair, untinned solid copper.

1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
3. Plenum Cable: Listed and labeled for plenum installation.

2.18 RACEWAYS

A. Conduit and Boxes: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical 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 to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. 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.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. 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.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

D. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

E. Wall-Mounted Outlets: Flush mounted.

F. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

G. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

H. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

I. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: System vendor will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

    a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
    b. Repeat test for each separately controlled zone of loudspeakers.
    c. Minimum acceptance ratio is 50 dB.

5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
8. Signal Ground Test: Measure and report ground resistance at pubic address equipment signal ground. Comply with testing requirements specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

F. Public address and mass notification systems will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

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.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the public address and mass notification systems and equipment.

END OF SECTION 27 51 16

SECTION 27 51 23 - INTERCOMMUNICATIONS AND PROGRAM 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: Intercommunications and program systems with the following components:

1. Master stations.
2. Speaker-microphone stations.
3. Intercommunication amplifier.
4. Paging amplifier.
5. Conductors and cables.
6. Raceways.

1.3 SUBMITTALS

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

B. Shop Drawings: For intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include scaled drawings for master station that detail built-in equipment.
3. Wiring Diagrams: For power, signal, and control wiring.

    a. Identify terminals to facilitate installation, operation, and maintenance.
    b. Single-line diagram showing interconnection of components.
    c. Cabling diagram showing cable routing.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from Installers of the items involved.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Operation and Maintenance Data: For intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. A record of Owner's equipment-programming option decisions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

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 NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of ceiling-mounted speaker microphones 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 MANUFACTURERS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

2.2 FUNCTIONAL DESCRIPTION OF MANUALLY SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.

2. Communicating simultaneously with all other stations by actuating a single all-call switch.
3. Communicating with individual stations in privacy.
4. Including other master-station connections in a multiple-station conference call.
5. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
6. Overriding any conversation by a designated master station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
2. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
3. Communicating with individual stations in privacy.
4. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
5. Overriding any conversation by a designated master station.
6. Displaying selected station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

C. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.5 MASTER STATION FOR MICROPROCESSOR-SWITCHED SYSTEMS

A. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.

B. Volume Control: Regulates incoming-call volume.

C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.

D. Tone Annunciation: Momentary audible tone signal announces incoming calls.

E. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

F. Reset Control: Cancels call and resets system for next call.

G. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.6 SPEAKER-MICROPHONE STATIONS

A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.

B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.

C. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.

D. Speaker: 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.

E. Tone Annunciation: Recurring momentary tone indicates incoming calls.

F. Call Switch: Mount on faceplate. Permits calls to master station.

G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.

H. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

2.7 CALL-SWITCH UNIT

2.8 INTERCOMMUNICATION AMPLIFIER

A. Minimum Output Power: 2 W; adequate for all functions.

B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.

C. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.

D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.

E. Output Regulation: Maintains output level within 2 dB from full to no load.

F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.

G. Amplifier Protection: Prevents damage from shorted or open output.

2.9 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.

B. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.

C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.

1. Minimum Shielding Coverage on Conductors: 60 percent.

D. Plenum Cable: Listed and labeled for plenum installation.

2.10 RACEWAYS

A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

C. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical 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 to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. 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.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. 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.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

D. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 SYSTEM PROGRAMMING

A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Test originating station-to-station messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
4. Frequency Response Test: Determine frequency response of two transmission paths by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

    a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at speakers.
    b. Repeat test for four speaker microphones.
    c. Minimum acceptable ratio is 35 dB.

6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into a minimum of two selected intercommunication amplifiers. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
7. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
8. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

F. Intercommunications and program systems will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Perform startup service and initial system programming.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

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.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the intercommunications and program systems.

1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION 27 51 23

SECTION 27 53 13 - CLOCK 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. Master clock and program control unit.
2. Secondary indicating clocks.
3. Program signal devices.
4. Clock circuit power boosters.
5. Interface with public-address system.
6. System wire and cable.

1.3 DEFINITIONS

A. NIST: The National Institute of Science and Technology.

B. PC: Personal computer.

C. UTC: Universal time coordinated. The precisely measured time at zero degrees longitude; a worldwide standard for time synchronization.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Master clock and housing shall withstand the effects of earthquake motions determined according to ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual, for the following:

1. Master unit.
2. Indicating clocks.

3. Signal equipment.
4. Equipment enclosures and back boxes.
5. Accessory components.

B. Shop Drawings: For clock systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring and correction circuits.

a. Identify terminals and wiring color codes to facilitate installation, operation, and maintenance.
b. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Show protection from overcurrent, static discharge, and voltage surge.

2. Details of seismic strengthening of master clock enclosures and mounting racks.
3. Dimensioned Outline Drawings of the Mounting Rack for the Master Clock: Show center of gravity of fully equipped and assembled unit. Locate and describe mounting and anchorage provisions.

C. Samples for Initial Selection:

1. Representative operating models of each clock type.

D. Seismic Qualification Certificates: For the master clock, 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.

E. Field quality-control reports.

F. Operation and Maintenance Data: For clock and program control to include in emergency, operation, and maintenance manuals.

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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MASTER AND SECONDARY CLOCK SYSTEM

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Time & Signal Co.
2. AtlasIED.
3. Edwards Signaling & Security Systems; Part of GE Infrastructure, Security.
4. Federal Signal Corporation.

B. System Functions and Features:

1. Supply power to remote indicating clocks.
2. Maintain correct synchronized time and transmit time-correction signals over dedicated system wiring from a master clock to any type(s) of secondary indicating clocks, including the following:

    a. Analog Synchronous Clocks: Correct for minute- and second-hand synchronization at least once each hour and for hour-hand synchronization at least once each day.
    b. Digital Clocks: Test clocks automatically for synchronization with master time control at least once every hour and automatically correct those not synchronized with the time reference unit. Automatically correct clocks immediately when power is restored after an outage of power to the master clock.

3. Communicate with remote PC for access to UTC time base and to permit programming from remote location.
4. Maintain system access security with a minimum of one level of user-access control to restrict use of system controls to authorized personnel. Access to user programming and control functions is accomplished by entering a minimum three-digit code. Access shall provide all user-programming and control functions.
5. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator.
6. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator, and automated periodic reference to NIST or UTC time signals via internet modem. Reference time signals shall be automatically accessed at programmable intervals.
7. Provide for programming multiple independent event schedules into memory and running them simultaneously for different output circuits.

    a. Quantity of Programmable Schedules: Four, minimum.
    b. Number of Weekly Events That Can Be Programmed for Each Schedule: 64, minimum.
    c. Simultaneous operation of independent schedules shall be limited only by the number of signal-device and equipment-switching output circuits.
    d. Advance Programming for Automatic Holiday Schedule Changes: Number of schedule changes that can be programmed to suit holidays and vacations shall be 50, and each change may be programmed up to a year in advance to occur on any day of the calendar year.

8. Automatically check functioning of LEDs, switches, input keys, central processor, read-only memory, random access memory, and output circuits. A display on the control panel shall indicate failure by identifying faulty component or circuit and shall recommend corrective action.
9. Provide programming for automatic daylight savings time correction.
10. Provide for adjustments to master clock output signals. Duration of momentary signal shall be individually programmable for each signal and equipment-control output circuit

from 1 to 99 seconds. Signals shall be programmable for either on or off switching to suit equipment-operation scheduling.

2.2 MASTER CLOCK

A. Description: Microprocessor-based, software-controlled unit complying with Class A device requirements in 47 CFR 15.

1. Programming and control switches.
2. Informational Display: LED or backlit LCD type.
    a. Normally shows current time, date, and day of the week display.
    b. Provides programming cues when system is being programmed.
3. Output Circuits for Power and Correction of Secondary Indicating Clocks:
    a. Wired Synchronous Clock Power-and-Correction Circuits: For analog and digital clocks; a minimum of two required. Relay controlled.
4. Modem and PC interface software suitable for automatic NIST or UTC synchronization.
5. Ports to receive Public Address and Mass Notification System Signals and transmit to Audible Signal Devices as part of the system specified in Section 275116 “Public Address and Mass Notification Systems”.
6. Circuits for Audible Signal Devices: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, 10A minimum. A minimum of four circuits.
7. Power Supplies: Capacity for internal loads and power-and correction circuits of connected clocks.
8. Enclosure: Metal cabinet with locking front panel. When cabinet is locked, display indication shall be visible on or through front panel face. Arrange cabinet for surface, semirecessed, or flush mounting as indicated.
9. Housing: Rack-mounting metal enclosure with display indication visible on front panel face.
10. Battery Backup for Time Base: Lithium battery to maintain the timekeeping function and retain the programs in memory during outage of normal ac power supply for up to 10 years.
11. Electrostatic Discharge Resistance: Master clock shall be tested and certified according to IEC 61000-4-2 in both human-discharge and direct-injection modes.

2.3 SECONDARY INDICATING CLOCKS

A. Digital Clock: Microprocessor-controlled unit complying with Class A device requirements in 47 CFR 15, with red LED digital time display of hours and minutes.

1. Display Height: 2-1/2-Inch (64-mm) Clock: Hour and minute numerals readable at 50 feet (15 m).
2. Display Height: 4-Inch (102-mm) Clock: Hour and minute numerals readable at 100 feet (30 m).
3. Display Format: Selectable between 12-hour with "PM" LED display and 24-hour formats.
4. Connections for Power and Correction:

a. Wired synchronous connection to the master clock for both operating power and correction.

1) Time-Base Backup: Internal alkaline battery shall back up internal time base to maintain timekeeping during power outages of up to six days' duration.
2) Time-Base Backup: Internal capacitor shall back up internal time base to maintain timekeeping during power outages of up to 12 hours' duration.

b. Correction by RS485, Ethernet, or similar data line with operating power supplied over a separate connection.

B. Provision for Audible Signals: Indicated clocks shall include an acoustically treated and baffled speaker compartment to transmit Audible Signals in accordance with Section 275116 "Public Address and Mass Notification Systems."

2.4 PROGRAM SIGNAL DEVICES

A. Clock Buzzers: Adjustable output signal device designed for mounting within clock housing or outlet box.

1. Sound-Output Rating Measured at 3 Feet (1 m): 75 dB.
2. Audible Tone Frequency: Manufacturer's standard between 120 Hz and 2 kHz.

B. Horns: Modular, adjustable-output, vibrating type with minimum full-intensity-rated sound output of 103 dB measured at 10 feet (3 m).

C. Loudspeakers for Audible Tones: See Section 275116 "Public Address and Mass Notification Systems."

D. Outdoor Signal Equipment: Weatherproof models listed for outdoor use.

E. Mounting Arrangement for Signal Devices: Designed for attachment with screws on the mounting plate of a flush-mounted back box unless otherwise indicated.

F. Enclosures for Flush-Mounting Bells and Horns: Enclosure, mounting plate, and grille assembly shall be furnished by device manufacturer to match features of the device to be mounted. Enclosure shall be recessed in wall, completely enclosing the device, with grille mounting over the open side of the enclosure and flush with the wall.

2.5 CLOCK CIRCUIT POWER BOOSTER

A. Description: Transformer power supply, mounted in steel cabinet with hinged door, and having fuse-protected input and output circuits.

2.6 GUARDS

A. Description: Formed-steel wire, shaped to fit around guarded device, with 1-inch (25-mm) maximum clearance.

1. Mounting Provisions: Fixed tabs, welded to guard and arranged for screw attachment to mounting surface.

2. Finish for Indoor Devices: Clear epoxy lacquer over zinc plating.
3. Finish for Outdoor Devices: Black powder coat over zinc plating and primer.

2.7 RACK-MOUNTING PROVISION FOR MASTER CLOCK

A. Equipment Cabinet: Independently-mounted or rack type. Comply with EIA-310-D and the following:

1. Cabinet Housing: Constructed of steel, with front doors; with manufacturer's standard tumbler locks, keyed alike.

    a. Front door shall have a clear panel in front of the master clock display.
    b. Housing shall enclose master clock and auxiliary clock system components, plus a minimum of 20 percent spare capacity for future equipment.

2. Forced Ventilation: Internal low-noise fan with a filtered intake vent, connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switchable and arranged to be powered when main cabinet power switch is on.
3. Natural Ventilation: Ventilated rear and sides with louvers and solid top.
4. Arrange inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
5. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by equipment or panels.
6. Finish: Uniform, baked-enamel, finish over rust-inhibiting primer.
7. Power-Control Panel: On front of equipment housing; with master power on-off switch and pilot light, and socket for a 5-A, indicating, cartridge fuse for rack equipment power.
8. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounting equipment.
9. Maintenance Receptacles: Duplex convenience outlet with supply terminals separate from equipment plug strip and located in front of rack.

2.8 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG. Voltage drop for signal, control, and clock correction circuits shall not exceed 10 percent under peak load conditions. Comply with requirements in Division 27 Section "Communications Horizontal Cabling."

B. 120-V AC and Class 1 Signal and Control Circuits: Stranded, single conductors of size and type recommended by system manufacturer. Materials and installation requirements are specified in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 2 and Class 3 Signal and Control Circuits: Single conductor or twisted-pair cable, unshielded, unless manufacturer recommends shielded cable.

D. Data Circuits: Category 6 minimum, unshielded, twisted-pair cable, unless manufacturer recommends shielded cable.

E. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.

F. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams.

G. Shielding: For speaker-microphone leads and at other locations recommended by manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or equivalent foil.

1. Minimum Shielding Coverage on Conductors: 60 percent.

2.9 PATHWAYS

A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

C. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

D. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical 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 to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Support cables not enclosed in raceways on J-Hooks. Install, size, and space J-Hooks to comply with TIA/EIA-568-B.

3.2 ELECTRICAL CONNECTIONS

A. Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

B. Use plug connectors for connections to clocks and signal devices.

C. Ground clocks, programming equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.3 IDENTIFICATION

A. Comply with SED Manual of Planning Standards section “Electrical Identification”.

B. Color-code wires, and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installation, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

D. Clock system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Program system according to Owner's requirements. Set system so signal devices operate on Owner-required schedules and are activated for durations selected by Owner. Program equipment-control output circuits to suit Owner's operating schedule for equipment controlled.

B. Adjust sound-output level of adjustable signal devices to suit Owner's requirements.

C. 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.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain clock-and-program-control system components.

END OF SECTION 27 53 13

SECTION 28 05 00 - COMMON WORK RESULTS 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. Electronic safety and security equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electronic safety and security installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level.

G. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 28 05 00

SECTION 28 05 13 - 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. UTP cabling.
2. 62.5/125-micrometer, multimode optical fiber cabling.
3. Coaxial cabling.
4. RS-232 cabling.
5. RS-485 cabling.
6. Low-voltage control cabling.
7. Control-circuit conductors.
8. Fire alarm wire and cable.
9. Identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. 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.

E. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

F. RCDD: Registered Communications Distribution Designer.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Pathways shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[and the unit will be fully operational after the seismic event]."

1.5 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to side of cable trays.
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For pathways, 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.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Data: For wire and cable to include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Allowable pulling tension of cable.
2. Cable connectors and terminations recommended by the manufacturer.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use 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.
3. Test each pair of UTP cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial 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.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of [Category 5e] [Category 6] cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Cable Trays:

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; a business unit of Tyco Electrical & Metal Products.
b. Cablofil.
c. Cooper B-Line, Inc.
d. GS Metals Corp.
e. Snaketray; Cable Management Solutions, Inc.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

    a. Basket Cable Trays: Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
    b. Trough Cable Trays:
    c. Ladder Cable Trays:
    d. Channel Cable Trays: One-piece construction Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
    e. Solid-Bottom Cable Trays: One-piece construction,. Provide with solid covers.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

D. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 UTP 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. ADC.
2. AMP Netconnect; a brand of Tyco Electronics Corporation.
3. Belden CDT Networking Division/NORDX.
4. Belden Inc.
5. Berk-Tek; a Nexans company.
6. CommScope, Inc.
7. Draka Cableteq USA.
8. Genesis Cable Products; Honeywell International, Inc.
9. Mohawk; a division of Belden.
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope, Inc. brand.
12. 3M; Communication Markets Division.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, [Category 5e] [Category 6].
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG

b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.
e. Multipurpose: Type MP or MPG.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP 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. ADC.
2. American Technology Systems Industries, Inc.
3. AMP Netconnect; a brand of Tyco Electronics Corporation.
4. Belden CDT Networking Division/NORDX.
5. Dynacom Corporation.
6. Hubbell Incorporated; Hubbell Premise Wiring.
7. Leviton Voice & Data Division.
8. Molex Premise Networks; a division of Molex, Inc.
9. PANDUIT CORP.
10. Siemon.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. 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.

2.5 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 brand of Tyco Electronics Corporation.
2. Belden CDT Networking Division/NORDX.
3. Berk-Tek; a Nexans company.
4. CommScope, Inc.
5. Corning Incorporated; Corning Cable Systems.
6. CSI Technologies Inc.
7. General Cable Technologies Corporation.
8. Mohawk; a division of Belden.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M; Communication Markets Division.

B. Description: Multimode, 62.5/125-micrometer, 24-fiber, [nonconductive,]tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.

3. Comply with [TIA-492AAAB] [TIA-492AAAA-A] 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 OFNG.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
    d. General Purpose, Conductive: Type OFC or OFCG.
    e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
    f. Riser Rated, Conductive: Type OFCR, 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: Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 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. ADC.
2. American Technology Systems Industries, Inc.
3. Belden CDT Networking Division/NORDX.
4. Berk-Tek; a Nexans company.
5. Corning Incorporated; Corning Cable Systems.
6. CSI Technologies Inc.
7. Dynacom Corporation.
8. Hubbell Incorporated; Hubbell Premise Wiring.
9. Molex Premise Networks; a division of Molex, Inc.
10. Siemon.

B. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, 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.

2.7 COAXIAL 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. Alpha Wire Company.
2. Belden CDT Networking Division/NORDX.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka Cableteq USA.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG59/U: NFPA 70, Type CATVR.

1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
4. Color-coded PVC jacket.

E. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

F. RG59/U: NFPA 70, Type CATV.

1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
3. PVC jacket.

G. RG59/U (Plenum Rated): NFPA 70, Type CMP.

1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
3. Copolymer jacket.

H. NFPA and UL Compliance: Coaxial cables shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV.

2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL 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. Emerson Network Power Connectivity Solutions; AIM Electronics brand.
2. Leviton Voice & Data Division.
3. Siemon.

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM[or CMG].

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.

3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, [No. 16 AWG, stranded (19x29)] [and] [No. 18 AWG, stranded (19x30)] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, [No. 16 AWG, stranded (19x29)] [and] [No. 18 AWG, stranded (19x30)] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway].

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.13 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 UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.14 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-B.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems." for installation of supports for pathways, conductors and cables.

3.3 WIRING METHOD

A. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Install cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.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.
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. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
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.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

1. Comply with TIA/EIA-568-B.2.

2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

E. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

F. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

G. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data 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 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 (75 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Division 26 Section "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 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 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. 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/EIA-568-B.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 meet or exceed applicable requirements in TIA/EIA-568-B.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 meet or exceed applicable requirements in TIA/EIA-568-B.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 1 direction according to TIA-526-14-A, 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/EIA-568-B.1.

5. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."

D. 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.

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 28 05 13

SECTION 281300 - ACCESS CONTROL

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. Security access central-control station.
2. One or more security access networked workstations.
3. Security access operating system and application software.
4. Security access controllers connected to high-speed electronic-data transmission network.

1.3 DEFINITIONS

A. CCTV: Closed-circuit television.

B. CPU: Central processing unit.

C. Credential: Data assigned to an entity and used to identify that entity.

D. dpi: Dots per inch.

E. DTS: Digital Termination Service. A microwave-based, line-of-sight communication provided directly to the end user.

F. GFI: Ground fault interrupter.

G. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

H. I/O: Input/Output.

I. LAN: Local area network.

J. Location: A Location on the network having a PC-to-controller communications link, with additional controllers at the Location connected to the PC-to-controller link with a TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.

K. PC: Personal computer. Applies to the central station, workstations, and file servers.

L. PCI Bus: Peripheral Component Interconnect. A peripheral bus providing a high-speed data path between the CPU and the peripheral devices such as a monitor, disk drive, or network.

M. PDF: Portable Document Format. The file format used by the Acrobat document-exchange-system software from Adobe.

N. RAS: Remote access services.

O. RF: Radio frequency.

P. ROM: Read-only memory. ROM data are maintained through losses of power.

Q. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

R. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.

S. UPS: Uninterruptible power supply.

T. USB: Universal serial bus.

U. WAN: Wide area network.

V. WAV: The digital audio format used in Microsoft Windows.

W. WMP: Windows media player.

X. Windows: Operating system by Microsoft Corporation.

Y. Workstation: A PC with software that is configured for specific, limited security-system functions.

Z. WYSIWYG: What You See Is What You Get. Text and graphics appear on the screen the same as they will in print.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

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

1. Diagrams for cable management system.

2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
3. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:

a. Workstation outlets, jacks, and jack assemblies.
b. Patch cords.
c. Patch panels.

4. Cable Administration Drawings: As specified in "Identification" Article.

5. Battery and charger calculations for central station, workstations, and controllers.

C. Samples: For workstation outlets, jacks, jack assemblies, and faceplates. For each exposed product and for each color and texture specified.

D. Other Action Submittals:

1. Project planning documents as specified in Part 3.

E. Field quality-control reports.

F. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Microsoft Windows software documentation.
2. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
3. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
4. System installation and setup guides with data forms to plan and record options and setup decisions.

1.5 QUALITY ASSURANCE

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

1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.

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, "National Electrical Code."

E. Comply with SIA DC-03.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Central Station, Workstations, and Controllers:

1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.

3. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F (16 to 30 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of **36 to 122 deg F (2 to 50 deg C)** dry bulb and 20 to 90 percent relative humidity, noncondensing.
3. Indoor, Uncontrolled Environment: NEMA 250, Type 3R enclosures. System components installed in non-temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of **0 to 122 deg F (minus 18 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, noncondensing.
4. Outdoor Environment: NEMA 250, NEMA 250, Type 4 enclosures. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of **minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)** dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) **and snow cover up to 24 inches (610 mm) thick**.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Products shall be from the same manufacturer as the existing campus system.

2.2 DESCRIPTION

A. Security Access System: PC-based central station and field-installed controllers, connected by a high-speed electronic-data transmission network.

B. System Software: Based on 32-bit, Windows central-station, workstation operating system, server operating system, and application software. Software shall have the following capabilities:

1. Multiuser and multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
2. Graphical user interface to show pull-down menus and a menu-tree format that complies with interface guidelines of Microsoft Windows.
3. System license for the entire system including capability for future additions that are within the indicated system size limits specified in this Section.

4. Open-architecture system that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows.
5. Password-protected operator login and access.
6. Open-database-connectivity compliant.

C. Network connecting the central station and workstations shall be a LAN or WAN using Microsoft Windows-based TCP/IP with a capacity of connecting up to 99 workstations. System shall be portable across multiple communication platforms without changing system software.

D. Network(s) connecting PCs and controllers shall consist of one or more of the following:

1. Local area, IEEE 802.3 Fast Ethernet, star topology network based on TCP/IP.
2. Direct-connected, RS-232 cable from the COM port of the central station to the first controller, then RS-485 cable to interconnect the remaining controllers at that Location.
3. Dial-up and cable modem connection using a standard cable or dial-up telephone line.

2.3 OPERATION

A. Security access system shall use a single database for access-control and credential-creation functions.

B. Distributed Processing: A fully distributed processing system.

1. Access-control information, including time, date, valid codes, access levels, and similar data, shall be downloaded to controllers so each controller can make access-control decisions.
2. Intermediate controllers for access control are prohibited.
3. In the event that communications with the central controller are lost, controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the central station.

C. Number of Locations:

1. Support at least 32000 separate Locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each Location.
2. Each Location shall have its own database and history in the central station.
3. Locations may be combined to share a common database.

D. Data Capacity:

1. 130 different card-reader formats.
2. 999 comments.
3. 48 graphic file types for importing maps.

E. Location Capacity:

1. 128 reader-controlled doors.
2. 50000 total-access credentials.
3. 2048 supervised alarm inputs.
4. 2048 programmable outputs.
5. 32000 custom action messages per Location to instruct operator on action required when alarm is received.

F. System Network Requirements:

1. System components shall be interconnected and shall provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
2. Communication shall not require operator initiation or response and shall return to normal after partial- or total-network interruption such as power loss or transient upset.
3. System shall automatically annunciate communication failures to the operator and shall identify the communications link that has experienced a partial or total failure.

4. Communications controller may be used as an interface between the central-station display systems and the field device network. Communications controller shall provide functions required to attain the specified network communications performance.

G. Central station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Central station shall control system networks to interconnect all system components, including workstations and field-installed controllers.

H. Field equipment shall include controllers, sensors, and controls.

1. Controllers shall serve as an interface between the central station and sensors and controls.
2. Data exchange between the central station and the controllers shall include down-line transmission of commands, software, and databases to controllers.
3. The up-line data exchange from the controller to the central station shall include status data such as intrusion alarms, status reports, and entry-control records.
4. Controllers are classified as alarm-annunciation or entry-control type.

I. System Response to Alarms:

1. Field device network shall provide a system end-to-end response time of one second(s) or less for every device connected to the system.
2. Alarms shall be annunciated at the central station within one second of the alarm occurring at a controller or at a device controlled by a local controller, and within 100 ms if the alarm occurs at the central station.
3. Alarm and status changes shall be displayed within 100 ms after receipt of data by the central station.
4. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within five seconds of alarm receipt at the security console.

5. This response time shall be maintained during system heavy load.

J. False-Alarm Reduction: The design of the central station and controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

K. Error Detection:

1. Use a cyclic code method to detect single- and double-bit errors, burst errors of eight bits or fewer, and at least 99 percent of all other multibit and burst errors between controllers and the central station.
2. Interactive or product error-detection codes alone will not be acceptable.
3. A message shall be in error if one bit is received incorrectly.
4. Retransmit messages with detected errors.
5. Allow for an operator-assigned two-digit decimal number to each communications link representing the number of retransmission attempts.

6. Central station shall print a communication failure alarm message when the number of consecutive retransmission attempts equals the assigned quantity.
7. Monitor the frequency of data transmission failure for display and logging.

L. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

M. Door Hardware Interface:

1. Comply with requirements in Division 08 Sections for door hardware required to be monitored or controlled by the security access system.
2. Electrical characteristics of controllers shall match the signal and power requirements of door hardware.

2.4 APPLICATION SOFTWARE

A. System Software: Based on 32 Microsoft Windows central-station and workstation operating system and application software.

1. Multiuser multitasking shall allow independent activities and monitoring to occur simultaneously at different workstations.
2. Graphical user interface shall show pull-down menus and a menu-tree format.
3. Capability for future additions within the indicated system size limits.
4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
5. Password-protected operator login and access.

B. Peer Computer Control Software: Detect a failure of a central computer and cause the other central computer to assume control of all system functions without interruption of operation. Both central computers shall have drivers to support this mode of operation.

C. Application Software: Interface between the alarm annunciation and entry-control controllers to monitor sensors, operate displays, report alarms, generate reports, and help train system operators.

1. Reside at the central station, workstations, and controllers as required to perform specified functions.
2. Operate and manage peripheral devices.
3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
4. Import custom icons into graphics to represent alarms and I/O devices.
5. Globally link I/O so that any I/O can link to any other I/O within the same Location without requiring interaction with the host PC. This operation shall be at the controller.
6. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host PC. This operation shall be at the controller.
7. Messages from PC to controllers and controllers to controllers shall be on a polled network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.

8. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
9. Automatic and encrypted backups for database and history backups shall be automatically stored at the central control PC and encrypted with a nine-character alphanumeric password that must be used to restore or read data contained in backup.
10. Operator audit trail for recording and reporting all changes made to database and system software.
11. Support network protocol and topology, TCP/IP, Novel Netware, Digital Pathworks, Banyan Vines, LAN/WAN, and RAS.

D. Workstation Software:

1. Password levels shall be individually customized at each workstation to allow or disallow operator access to program functions for each Location.

2. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

E. Controller Software:

1. Controllers shall operate as autonomous, intelligent processing units.

   a. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door-locking schedules for their operation, independent of other system components.
   b. Controllers shall be part of a fully distributed processing-control network.
   c. The portion of the database associated with a controller, and consisting of parameters, constraints, and the latest value or status of points connected to that controller, shall be maintained in the controller.

2. The following functions shall be fully implemented and operational within each controller:

   a. Monitoring inputs.
   b. Controlling outputs.
   c. Automatically reporting alarms to the central station.
   d. Reporting of sensor and output status to the central station on request.
   e. Maintaining real time, automatically updated by the central station at least once a day.
   f. Communicating with the central station.
   g. Executing controller resident programs.
   h. Diagnosing.
   i. Downloading and uploading data to and from the central station.

3. Controller Operations at a Location:

   a. Up to 64 controllers connected to TIA 485-A communications loop. Globally operating I/O linking and anti-passback functions between controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same Location even when the central station or workstations are off-line.

b. In the event of communication failure between the central station and a Location, there shall be no degradation in operations at the controllers at that Location. Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
c. Buffered events shall be handled in a first-in-first-out mode of operation.

4. Individual Controller Operation:

a. Controllers shall transmit alarms, status changes, and other data to the central station when communications circuits are operable. If communications are not available, controllers shall function in a stand-alone mode; operational data, including the status and alarm data normally transmitted to the central station, shall be stored for later transmission to the central station. Storage capacity for the latest 1024 events shall be provided at each controller.
b. Card-reader ports of a controller shall be custom configurable for at least 120 different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different controllers or within the same controller.
c. Controllers shall provide a response to card readers or keypad entries in less than 0.25 seconds, regardless of system size.
d. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to their proper working state. This shall happen without any operator intervention.
e. Initial Startup: When controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each controller.
f. On failure for any reason, controllers shall perform an orderly shutdown and force controller outputs to a predetermined failure-mode state, consistent with the failure modes shown and the associated control device.
g. After power is restored, following a power failure, startup software shall initiate self-test diagnostic routines, after which controllers shall resume normal operation.
h. After controller failure, if the database and application software are no longer resident, controllers shall not restart but shall remain in the failure mode until repaired. If database and application programs are resident, controllers shall immediately resume operation. If not, software shall be restored automatically from the central station.

5. Communications Monitoring:

a. System shall monitor and report status of TIA 485-A communications loop of each Location.

b. Communication status window shall display which controllers are currently communicating, a total count of missed polls since midnight, and which controller last missed a poll.
c. Communication status window shall show the type of CPU, the type of I/O board, and the amount of RAM for each controller.

6. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the central station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

F. PC-to-Controller Communications:

1. Central-station or workstation communications shall use the following:

   a. Direct connection using serial ports of the PC.
   b. TCP/IP LAN interface cards.
   c. Dial-up or cable modems for connections to Locations.

2. Each serial port used for communications shall be individually configurable for "direct communications," "modem communications incoming and outgoing," or "modem communications incoming only," or as an ASCII output port. Serial ports shall have adjustable data transmission rates and shall be selectable under program control.

3. Use multiport communications board if more than two serial ports are needed.

   a. Use a 4-, 8-, or 16-serial port configuration that is expandable to 32- or 64-serial ports.
   b. Connect the first board to an internal PCI bus adapter card.

4. Direct serial, TCP/IP, and dial-up, cable, or satellite communications shall be alike in the monitoring or control of the system except for the connection that must first be made to a dial-up or voice-over IP Location.

5. TCP/IP network interface card (NIV) shall have an option to set the poll-frequency and message-response time-out settings.
6. PC-to-controller and controller-to-controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each message. All communications in this subparagraph shall be verified and buffered, and retransmitted if not acknowledged.

G. Direct Serial or TCP/IP PC-to-Controller Communications:

1. Communication software on the PC shall supervise the PC-to-controller communications link.
2. Loss of communications to any controller shall result in an alarm at all PCs running the communication software.
3. When communications are restored, all buffered events shall automatically upload to the PC, and any database changes shall be automatically sent to the controller.

H. Controller-to-Controller Communications:

1. TIA 485-A, four-wire, point-to-point, regenerative (repeater) communications network methodology.
2. TIA 485-A communications signal shall be regenerated at each controller.

I. Database Downloads:

1. All data transmissions from PCs to a Location, and between controllers at a Location, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.
2. If a controller is reset for any reason, it shall automatically request and receive a database download from the PC. The download shall restore data stored at the controller to their normal working state and shall take place with no operator intervention.

3. Software shall provide for setting downloads via dial-up connection to once per 24-hour period, with time selected by the operator.

4. Software shall provide for setting delays of database downloads for dial-up connections. Delays change the download from immediately to a delay ranging from one to 999 minutes.

J. Operator Interface:

1. Inputs in system shall have two icon representations, one for the normal state and one for the abnormal state.
2. When viewing and controlling inputs, displayed icons shall automatically change to the proper icon to display the current system state in real time. Icons shall also display the input's state, whether armed or bypassed, and if the input is in the armed or bypassed state due to a time zone or a manual command.
3. Outputs in system shall have two icon representations, one for the secure (locked) state and one for the open (unlocked) state.
4. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.
5. The operator shall be able to scroll the list of I/Os and press the appropriate toolbar button, or right click, to command the system to perform the desired function.
6. Graphic maps or drawings containing inputs, outputs, and override groups shall include the following:

    a. Database to import and store full-color maps or drawings and allow for input, output, and override group icons to be placed on maps.
    b. Maps to provide real-time display animation and allow for control of points assigned to them.
    c. System to allow inputs, outputs, and override groups to be placed on different maps.
    d. Software to allow changing the order or priority in which maps will be displayed.

7. Override Groups Containing I/Os:

    a. System shall incorporate override groups that provide the operator with the status and control over user-defined "sets" of I/Os with a single icon.
    b. Icon shall change automatically to show the live summary status of points in that group.
    c. Override group icon shall provide a method to manually control or set to time-zone points in the group.
    d. Override group icon shall allow the expanding of the group to show icons representing the live status for each point in the group, individual control over each point, and the ability to compress the individual icons back into one summary icon.

8. Schedule Overrides of I/Os and Override Groups:

    a. To accommodate temporary schedule changes that do not fall within the holiday parameters, the operator shall have the ability to override schedules individually for each input, output, or override group.
    b. Each schedule shall be composed of a minimum of two dates with separate times for each date.
    c. The first time and date shall be assigned the override state that the point shall advance to when the time and date become current.

d. The second time and date shall be assigned the state that the point shall return to when the time and date become current.

9. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.

K. Operator Access Control:

1. Control operator access to system controls through three password-protected operator levels. System operators and managers with appropriate password clearances shall be able to change operator levels for operators.
2. Three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period shall initiate a software tamper alarm.
3. A minimum of 32 passwords shall be available with the system software. System shall display the operator's name or initials in the console's first field. System shall print the operator's name or initials, action, date, and time on the system printer at login and logoff.
4. The password shall not be displayed or printed.
5. Each password shall be definable and assignable for the following:

a. Selected commands to be usable.
b. Access to system software.
c. Access to application software.
d. Individual zones that are to be accessed.
e. Access to database.

L. Operator Commands:

1. Command Input: Plain-language words and acronyms shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be a word, a phrase, or an acronym.
2. Command inputs shall be acknowledged and processing shall start in not less than one second(s).
3. Tasks that are executed by operator's commands shall include the following:

a. Acknowledge Alarms: Used to acknowledge that the operator has observed the alarm message.
b. Place Zone in Access: Used to remotely disable intrusion-alarm circuits emanating from a specific zone. System shall be structured so that console operator cannot disable tamper circuits.
c. Place Zone in Secure: Used to remotely activate intrusion-alarm circuits emanating from a specific zone.
d. System Test: Allows the operator to initiate a system-wide operational test.
e. Zone Test: Allows the operator to initiate an operational test for a specific zone.
f. Print reports.
g. Change Operator: Used for changing operators.
h. Security Lighting Controls: Allows the operator to remotely turn on or turn off security lights.
i. Display Graphics: Used to show any graphic displays implemented in the system. Graphic displays shall be completed within 20 seconds from time of operator command.
j. Run system tests.
k. Generate and format reports.

l. Request help with the system operation.

1) Include in main menus.
2) Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.
3) Provide navigation to specific topic from within the first help window.
4) Help shall be accessible outside the application program.

m. Entry-Control Commands:

1) Lock (secure) or unlock (open) each controlled entry and exit up to four times a day through time-zone programming.
2) Arm or disarm each monitored input up to four times a day through time-zone programming.
3) Enable or disable readers or keypads up to two times a day through time-zone programming.
4) Enable or disable cards or codes up to four times a day per entry point through access-level programming.

4. Command Input Errors: Show operator input assistance when a command cannot be executed because of operator input errors. Assistance screen shall use plain-language words and phrases to explain why the command cannot be executed. Error responses that require an operator to look up a code in a manual or other document are not acceptable. Conditions causing operator assistance messages include the following:

a. Command entered is incorrect or incomplete.
b. Operator is restricted from using that command.
c. Command addresses a point that is disabled or out of service.
d. Command addresses a point that does not exist.
e. Command is outside the system's capacity.

M. Alarms:

1. System Setup:

a. Assign manual and automatic responses to incoming-point status change or alarms.
b. Automatically respond to input with a link to other inputs, outputs, or operator-response plans; unique sound with use of WAV files; and maps or images that graphically represent the point location.
c. Sixty-character message field for each alarm.
d. Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point.
e. Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
f. Allow 25 secondary messages with a field of four lines of 60 characters each.
g. Store the most recent 1000 alarms for recall by the operator using the report generator.

2. Software Tamper:

a. Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.
b. Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond the authorization level.
c. Maintain a transcript file of the last 5000 commands entered at each central station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.
d. Allow only acknowledgment of software tamper alarms.

3. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.
4. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
5. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.
6. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
7. Alarm Automation Interface: High-level interface to central-station alarm automation software systems. Allows input alarms to be passed to and handled by automation systems in the same manner as burglar alarms, using a TIA 232-F ASCII interface.
8. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.
9. Camera Control: Provides operator ability to select and control cameras from graphic maps.

N. Alarm Monitoring: Monitor sensors, controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms.

1. Displayed alarm data shall include type of alarm, location of alarm, and secondary alarm messages.
2. Printed alarm data shall include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.
3. Maps shall automatically display the alarm condition for each input assigned to that map if that option is selected for that input location.
4. Alarms initiate a status of "pending" and require the following two handling steps by operators:

   a. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
   b. Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm shall then clear.

5. Each workstation shall display the total pending alarms and total unresolved alarms.
6. Each alarm point shall be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.

7. Alarms shall transmit to the central station in real time except for allowing connection time for dial-up locations.
8. Alarms shall be displayed and managed from a minimum of four different windows.

    a. Input Status Window: Overlay status icon with a large red blinking icon. Selecting the icon will acknowledge the alarm.
    b. History Log Transaction Window: Display name, time, and date in red text. Selecting red text will acknowledge the alarm.
    c. Alarm Log Transaction Window: Display name, time, and date in red. Selecting red text will acknowledge the alarm.
    d. Graphic Map Display: Display a steady colored icon representing each alarm input location. Change icon to flashing red when the alarm occurs. Change icon from flashing red to steady red when the alarm is acknowledged.

9. Once an alarm is acknowledged, the operator shall be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.
10. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment shall clear the alarm.
11. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.
12. Identical alarms from the same alarm point shall be acknowledged at the same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.
13. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and controllers.
14. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed.

O. Monitor Display: Display text and graphic maps that include zone status integrated into the display. Colors are used for the various components and current data. Colors shall be uniform throughout the system.

1. Color Code:

    a. FLASHING RED: Alerts operator that a zone has gone into an alarm or that primary power has failed.
    b. STEADY RED: Alerts operator that a zone is in alarm and alarm has been acknowledged.
    c. YELLOW: Advises operator that a zone is in access.
    d. GREEN: Indicates that a zone is secure and that power is on.

2. Graphics:

    a. Support 32,000 graphic display maps and allow import of maps from a minimum of 16 standard formats from another drawing or graphics program.
    b. Allow I/O to be placed on graphic maps by the drag-and-drop method.
    c. Operators shall be able to view the inputs, outputs, and the point's name by moving the mouse cursor over the point on the graphic map.
    d. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps associated with I/Os.
    e. Each graphic map shall have a display-order sequence number associated with it to provide a predetermined order when toggled to different views.

f. Camera icons shall have the ability to be placed on graphic maps that, when selected by an operator, will open a video window, display the camera associated with that icon, and provide pan-tilt-zoom control.
g. Input, output, or camera placed on a map shall allow the ability to arm or bypass an input, open or secure an output, or control the pan-tilt-zoom function of the selected camera.

P. System test software enables operators to initiate a test of the entire system or of a particular portion of the system.

1. Test Report: The results of each test shall be stored for future display or printout. The report shall document the operational status of system components.

Q. Report-Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest-priority activity. Report-generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.

1. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of the period; and the default printer.
2. Printing on Request: An operator may request a printout of any report.
3. Alarm Reports: Reporting shall be automatic as initially set up. Include alarms recorded by system over the selected time and information about the type of alarm , the type of sensor, the location, the time, and the action taken.
4. Access and Secure Reports: Document zones placed in access, the time placed in access, and the time placed in secure mode.
5. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.
6. Automatic History Reports: Named, saved, and scheduled for automatic generation.
7. Cardholder Reports: Include data, or selected parts of the data, as well as the ability to be sorted by name, card number, imprinted number, or by any of the user-defined fields.
8. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.
9. Cardholder by Access-Level Reports: Display everyone that has been assigned to the specified access level.
10. Panel Labels Reports: Printout of control-panel field documentation including the actual location of equipment, programming parameters, and wiring identification. Maintain system installation data within system database so that data are available on-site at all times.
11. Activity and Alarm On-Line Printing: Activity printers for use at workstations; prints all events, or alarms only.
12. History Reports: Custom reports that allow the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.

    a. Initially store history on the hard disk of the host PC.
    b. Permit viewing of the history on workstations or print history to any system printer.
    c. The report shall be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.

d. Each report shall depict the date, time, event type, event description, and device; or I/O name, cardholder group assignment, and cardholder name or code number.
e. Each line of a printed report shall be numbered to ensure that the integrity of the report has not been compromised.
f. Total number of lines of the report shall be given at the end of the report. If the report is run for a single event such as "Alarms," the total shall reflect how many alarms occurred during that period.

13. Reports shall have the following four options:

a. View on screen.
b. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to the system.
c. "Save to File" with full path statement.
d. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.

14. Custom Code List Subroutine: Allow the access codes of system to be sorted and printed according to the following criteria:

a. Active, inactive, or future activate or deactivate.
b. Code number, name, or imprinted card number.
c. Group, Location access levels.
d. Start and stop code range.
e. Codes that have not been used since a selectable number of days.
f. In, out, or either status.
g. Codes with trace designation.

15. The reports of system database shall allow options so that every data field may be printed.
16. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the data-entry windows.

R. Anti-Passback:

1. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
2. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes through a reader of opposite designation.
3. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.
4. Timed Anti-Passback: A controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.
5. Provide four separate zones per Location that can operate without requiring interaction with the host PC (done at controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.

6. The anti-passback schemes shall be definable for each individual door.
7. The Master Access Level shall override anti-passback.
8. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential-holder population anti-passback status to a neutral status.

S. Visitor Assignment:

1. Provide for and allow an operator to be restricted to only working with visitors. The visitor badging subsystem shall assign credentials and enroll visitors. Allow only those access levels that have been designated as approved for visitors.
2. Provide an automated log of visitor name, time and doors accessed, and name of person contacted.
3. Allow a visitor designation to be assigned to a credential holder.
4. Security access system shall be able to restrict the access levels that may be assigned to credentials issued to visitors.
5. Allow operator to recall visitors' credential-holder file once a visitor is enrolled in the system.
6. The operator may designate any reader as one that deactivates the credential after use at that reader. The history log shall show the return of the credential.
7. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

T. Time and Attendance:

1. Time and attendance reporting shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
2. Shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
3. System software setup shall allow designation of selected access-control readers as time and attendance hardware to gather the clock-in and clock-out times of the users at these readers.

    a. Reports shall show in and out times for each day, total time in for each day, and a total time in for period specified by the user.
    b. Allow the operator to view and print the reports, or save the reports to a file.
    c. Alphabetically sort reports on the person's last name, by Location or location group. Include all credential holders or optionally select individual credential holders for the report.

U. Training Software: Enables operators to practice system operation, including alarm acknowledgment, alarm assessment, response force deployment, and response force communications. System shall continue normal operation during training exercises and shall terminate exercises when an alarm signal is received at the console.

V. Entry-Control Enrollment Software: Database management functions that allow operators to add, delete, and modify access data as needed.

1. The enrollment station shall not have alarm response or acknowledgment functions.
2. Provide multiple, password-protected access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions.
3. The program shall provide means to disable the enrollment station when it is unattended, to prevent unauthorized use.

4. The program shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations. In the case of personnel identity-verification subsystems, this shall include biometric data. Allow entry of personnel identifying information into the system database using menu selections and data fields. The data field names shall be customized during setup to suit user and site needs. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
5. Cardholder Data: Provide 99 user-defined fields. System shall have the ability to run searches and reports using any combination of these fields. Each user-defined field shall be configurable, using any combination of the following features:

    a. MASK: Determines a specific format with which data must comply.
    b. REQUIRED: Operator is required to enter data into field before saving.
    c. UNIQUE: Data entered must be unique.
    d. DEACTIVATE DATE: Data entered will be evaluated as an additional deactivate date for all cards assigned to this cardholder.
    e. NAME ID: Data entered will be considered a unique ID for the cardholder.

6. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.
7. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.
8. Batch card printing.
9. Default card data can be programmed to speed data entry for sites where most card data are similar.
10. Enhanced ASCII File Import Utility: Allows the importing of cardholder data and images.
11. Card Expire Function: Allows readers to be configured to deactivate cards when a card is used at selected devices.

2.5 SYSTEM DATABASE

A. Database and database management software shall define and modify each point in database using operator commands. Definition shall include parameters and constraints associated with each system device.

B. Database Operations:

1. System data management shall be in a hierarchical menu-tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.

2. Navigational Aids:

    a. Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.
    b. Point and click feature to facilitate data manipulation.
    c. Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.

d. Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.

3. Data entry shall be automatically checked for duplicate and illegal data and shall be verified for valid format.
4. System shall generate a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose for which the item was entered, reasons for changes that were made, and the like.

C. File Management:

1. File management shall include database backup and restoration system, allowing selection of storage media, including 3.5-inch floppy disk, Zip and Jaz drives, and designated network resources.
2. Operations shall be both manual and automatic modes. The number of automatic sequential backups before the oldest backup will be overwritten; FIFO mode shall be operator selectable.
3. Backup program shall provide manual operation from any PC on the LAN and shall operate while system remains operational.

D. Operator Passwords:

1. Support up to 32000 individual system operators, each with a unique password.
2. One to sixteen alphanumeric characters.
3. Allow passwords to be case sensitive.
4. Passwords shall not be displayed when entered.
5. Passwords shall have unique and customizable password profile, and allow several operators to share a password profile. Include the following features in the password profile:

   a. Predetermine the highest-level password profile for access to all functions and areas of program.
   b. Allow or disallow operator access to any program operation, including the functions of View, Add, Edit, and Delete.
   c. Restrict doors to which an operator can assign access.

6. Operators shall use a user name and password to log on to system. This user name and password shall be used to access database areas and programs as determined by the associated profile.
7. Make provision to allow the operator to log off without fully exiting program. User may be logged off but program will remain running while displaying the login window for the next operator.

E. Access Card/Code Operation and Management: Access authorization shall be by card, by a manually entered code (PIN), or by a combination of both (card plus PIN).

1. Access authorization shall verify the facility code first, the card or card-and-PIN validation second, and the access level (time of day, day of week, date), anti-passback status, and number of uses last.
2. Use data-entry windows to view, edit, and issue access levels. Access-authorization entry-management system shall maintain and coordinate all access levels to prevent duplication or the incorrect creation of levels.
3. Allow assignment of multiple cards/codes to a cardholder.

4. Allow assignment of up to four access levels for each Location to a cardholder. Each access level may contain any combination of doors.
5. Each door may be assigned four time zones.
6. Access codes may be up to 11 digits in length.
7. Software shall allow the grouping of locations so cardholder data can be shared by all locations in the group.
8. Visitor Access: Issue a visitor badge for data tracking or photo ID purposes without assigning that person a card or code.
9. Cardholder Tracing: Allow for selection of cardholder for tracing. Make a special audible and visible annunciation at control station when a selected card or code is used at a designated code reader. Annunciation shall include an automatic display of the cardholder image.
10. Allow each cardholder to be given either an unlimited number of uses or a number from one to 9999 that regulates the number of times the card can be used before it is automatically deactivated.
11. Provide for cards and codes to be activated and deactivated manually or automatically by date. Provide for multiple deactivate dates to be preprogrammed.

F. Security Access Integration:

1. Photo ID badging and photo verification shall use the same database as the security access and may query data from cardholder, group, and other personal information to build a custom ID badge.
2. Automatic or manual image recall and manual access based on photo verification shall also be a means of access verification and entry.
3. System shall allow sorting of cardholders together by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.

G. Key control and tracking shall be an integrated function of cardholder data.

1. Provide the ability to store information about which conventional metal keys are issued and to whom, along with key construction information.
2. Reports shall be designed to list everyone who possesses a specified key.

H. Facility Codes: System shall accommodate up to 2048 facility codes per Location, with the option of allowing facility codes to work at all doors or only at particular doors.

I. Operator Comments:

1. With the press of one appropriate button on the toolbar, the user shall be permitted to enter operator comments into the history at any time.
2. Automatic prompting of operator comment shall occur before the resolution of each alarm.
3. Operator comments shall be recorded by time, date, and operator number.
4. Comments shall be sorted and viewed through reports and history.
5. The operator may enter comments in two ways; either or both may be used:
    a. Manually entered through keyboard data entry (typed), up to 65,000 characters per each alarm.
    b. Predefined and stored in database for retrieval on request.
6. System shall have a minimum of 999 predefined operator comments with up to 30 characters per comment.

J. Group:

1. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.
2. System software shall have the capacity to assign one of 32,000 group names to an access authorization.
3. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.
4. Allow sorting of history reports and code list printouts by group name.

K. Holidays:

1. Three different holiday schedules may be assigned to a time zone. Holiday schedule consists of date in format MM/DD/YYYY and a description. When the holiday date matches the current date of the time zone, the holiday schedule replaces the time-zone schedule for that 24-hour period.
2. System shall have the capacity for 32000 holidays.
3. Three separate holiday schedules may be applied to a time zone.
4. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in the system and will not be purged.
5. Holidays not designated to occur each year shall be automatically purged from the database after the date expires.

L. Access Levels:

1. System shall allow for the creation of up to 32000 access levels.
2. One level shall be predefined as the Master Access Level. The Master Access Level shall work at all doors at all times and override any anti-passback.
3. System shall allow for access to be restricted to any area by reader and by time. Access levels shall determine when and where an Identifier is authorized.
4. System shall be able to create multiple door and time-zone combinations under the same access level so that an Identifier may be valid during different time periods at different readers even if the readers are on the same controller.

M. User-Defined Fields:

1. System shall provide a minimum of 99 user-defined fields, each with up to 50 characters, for specific information about each credential holder.
2. System shall accommodate a title for each field; field length shall be 20 characters.
3. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.
4. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.
5. Data format option may be assigned to each user-defined field that will require the data to be entered with certain character types in specific spots in the field entry window.
6. A user-defined field, if selected, will define the field as a deactivate date. The selection shall automatically cause the data to be formatted with the windows MM/DD/YYYY date format. The credential of the holder will be deactivated on that date.
7. A search function shall allow any one user-defined field or combination of user-defined fields to be searched to find the appropriate cardholder. The search function shall include a search for a character string.

8. System shall have the ability to print cardholders based on and organized by the user-defined fields.

N. Code Tracing:

1. System shall perform code tracing selectable by cardholder and by reader.
2. Any code may be designated as a "traced code" with no limit to how many codes can be traced.
3. Any reader may be designated as a "trace reader" with no limit to which or how many readers can be used for code tracing.
4. When a traced code is used at a trace reader, the access-granted message that usually appears on the monitor window of the central station shall be highlighted with a different color than regular messages. A short singular beep shall occur at the same time the highlighted message is displayed on the window.
5. The traced cardholder image (if image exists) shall appear on workstations when used at a trace reader.

2.6 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits." as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

2.7 FIXED MAP DISPLAY

A. A fixed map display shall show layout of the protected facilities. Zones corresponding to those monitored by the system shall be highlighted on the display. Status of each zone shall be displayed using digital displays as required within each designated zone. A digital display test switch shall be provided on the map display.

2.8 CONTROLLERS

A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the central station or workstation for controlling its operation.

B. Subject to compliance with requirements in this article, manufacturers may use multipurpose controllers.

C. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.

D. Alarm Annunciation Controller:

1. The controller shall automatically restore communication within 10 seconds after an interruption with the field device network.

a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
b. Alarm-Line Supervision:

1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 10 percent or more for longer than 500 ms.
2) Transmit alarm-line-supervision alarm to the central station during the next interrogation cycle after the abnormal current condition.

c. Outputs: Managed by central-station software.

2. Auxiliary Equipment Power: A GFI service outlet inside the controller enclosure.

E. Entry-Control Controller:

1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personnel identity-verification devices, door strikes, magnetic latches, gate and door operators, and exit push buttons.

a. Operate as a stand-alone portal controller using the downloaded database during periods of communication loss between the controller and the field-device network.
b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:

1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
2) Privileges shall include, but are not limited to, time of day control, day of week control, group control, and visitor escort control.

c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.

2. Inputs:

a. Data from entry-control devices; use this input to change modes between access and secure.
b. Database downloads and updates from the central station that include enrollment and privilege information.

3. Outputs:

a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
b. Grant or deny entry by sending control signals to portal-control devices.
c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the central station.
d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.

4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.
5. Data Line Problems: For periods of loss of communication with the central station, or when data transmission is degraded and generating continuous checksum errors, the controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.

a. Store up to 1000 transactions during periods of communication loss between the controller and access-control devices for subsequent upload to the central station on restoration of communication.

6. Controller Power: NFPA 70, Class II power-supply transformer, with 12- or 24-V ac secondary, backup battery and charger.

a. Backup Battery: Recombinant-sealed, lead-calcium battery; spill proof; with a full one-year warranty and a pro rata 9-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
b. Backup Battery: Valve-regulated, recombinant-sealed, lead-acid battery; spill proof. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
c. Backup Power-Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.
d. Power Monitoring: Provide manual, dynamic battery-load test, initiated and monitored at the control center; with automatic disconnection of the controller when battery voltage drops below controller limits. Report by using local controller-mounted digital displays and by communicating status to central station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:

1) Trouble Alarm: Normal power-off load assumed by battery.
2) Trouble Alarm: Low battery.
3) Alarm: Power off.

2.9 SECONDARY ALARM ANNUNCIATOR

A. Secondary Alarm Annunciation Site: A workstation with limited I/O capacity, consisting of a secondary alarm annunciation workstation.

2.10 CARD READERS, CREDENTIAL CARDS, AND KEYPADS

A. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.

B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

C. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:

1. Indoors, controlled environment.
2. Indoors, uncontrolled environment.
3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

D. Display: Digital visual indicator shall provide visible and audible status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

E. Stripe Swipe Readers: Bidirectional, reading cards swiped in both directions, powered by the controller..

1. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
2. Readers for outdoors shall be in a polymeric plastic enclosure with all electronics potted in plastic. Rated for operation in ambient conditions of minus 40 to plus 160 deg F (minus 40 to plus 70 deg C) in a humidity range of 10 to 90 percent.

F. Wiegand Swipe Reader: Set up for 33-bit data cards. Comply with SIA AC-01.

G. Wiegand Key-Insert Reader: Set up for 33-bit data cards.

H. Bar-Code Reader: Set up for Code 39.

I. Insert Readers: Requiring the card to be inserted from the side, powered by the controller.

J. Touch-Plate and Proximity Readers:

1. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode a unique identification code number transmitted from the credential card.
2. Passive-detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.
3. The card reader shall read proximity cards in a range from direct contact to at least 6 inches (150 mm) from the reader.

K. Communication Protocol: Compatible with local processor.

L. Touch-Plate and Contactless Card Reader: The reader shall have "flash" download capability to accommodate card format changes. The card reader shall have capability of transmitting data to security control panel and shall comply with ISO/IEC 7816.

M. Credential Card Modification: Entry-control cards shall be able to be modified by lamination direct print process during the enrollment process without reduction of readability. The design of the credential cards shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the badge holder used at the site.

N. Card Size and Dimensional Stability: Credential cards shall be **2-1/8 by 3-3/8 inches (54 by 86 mm)**. The credential card material shall be dimensionally stable so that an undamaged card with deformations resulting from normal use shall be readable by the card reader.

O. Card Material: Abrasion resistant, nonflammable, nontoxic, and impervious to solar radiation and effects of ultraviolet light.

P. Card Construction:

1. Core and laminate or monolithic construction.
2. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.
3. Incorporate phosphorous ink as a security enhancement.
4. Furnish equipment for on-site assembly and lamination of credential cards.

2.11 PUSH-BUTTON SWITCHES

A. Basis-of-Design Product: Products shall be from the same manufacturer as the existing campus system.:

B. Push-Button Switches: Momentary-contact back-lighted push buttons with stainless-steel switch enclosures.

C. Electrical Ratings:

1. Minimum continuous current rating of 10 A at 120-V ac

D. Enclosures: Flush or surface mounting. Push buttons shall be suitable for flush mounting in the switch enclosures.

E. Enclosures shall additionally be suitable for installation in the following locations:

1. Indoors, controlled environment.
2. Indoors, uncontrolled environment.
3. Outdoors.

F. Power: Push-button switches shall be powered from their associated controller, using dc control.

2.12 DOOR AND GATE HARDWARE INTERFACE

A. Exit Device with Alarm: Operation of the exit device shall generate an alarm. Exit device and alarm contacts are specified in Division 08 Section "Door Hardware."

B. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Division 08 Section "Door Hardware."

C. Electric Door Strikes: Use end-of-line resistors to provide power-line supervision. Signal switches shall transmit data to controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and they shall report a forced entry. Power and signal shall be from the controller. Electric strikes are specified in Division 08 Section "Door Hardware."

D. Electromagnetic Locks: End-of-line resistors shall provide power-line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the controller. Electromagnetic locks are specified in Division 08 Section "Door Hardware."

2.13 FIELD-PROCESSING SOFTWARE

A. Operating System:

1. Local processors shall contain an operating system that controls and schedules that local processor's activities in real time.
2. Local processor shall maintain a point database in its memory that includes parameters, constraints, and the latest value or status of all points connected to that local processor.
3. Execution of local processor application programs shall utilize the data in memory resident files.
4. Operating system shall include a real-time clock function that maintains the seconds, minutes, hours, date, and month, including day of the week.
5. Local processor real-time clock shall be automatically synchronized with the central station at least once per day to plus or minus 10 seconds (the time synchronization shall be accomplished automatically, without operator action and without requiring system shutdown).

B. Startup Software:

1. Causes automatic commencement of operation without human intervention, including startup of all connected I/O functions.
2. Local processor restart program based on detection of power failure at the local processor shall be included in the local processor software.
3. Initiates operation of self-test diagnostic routines.
4. Upon failure of the local processor, if the database and application software are no longer resident, the local processor shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made.
5. If the database and application programs are resident, the local processor shall immediately resume operation.

C. Operating Mode:

1. Local processors shall control and monitor inputs and outputs as specified, independent of communications with the central station or designated workstations.
2. Alarms, status changes, and other data shall be transmitted to the central station or designated workstations when communications circuits are operable.

3. If communications are not available, each local processor shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the central station or designated workstations, shall be stored for later transmission to the central station or designated workstations.
4. Storage for the latest 4000 events shall be provided at local processors, as a minimum.
5. Local processors shall accept software downloaded from the central station.
6. Panel shall support flash ROM technology to accomplish firmware downloads from a central location.

D. Failure Mode: Upon failure for any reason, each local processor shall perform an orderly shutdown and force all local processor outputs to a predetermined (failure-mode) state, consistent with the failure modes shown and the associated control device.

E. Functions:

1. Monitoring of inputs.
2. Control of outputs.
3. Reporting of alarms automatically to the central station.
4. Reporting of sensor and output status to central station upon request.
5. Maintenance of real time, automatically updated by the central station at least once a day.
6. Communication with the central station.
7. Execution of local processor resident programs.
8. Diagnostics.
9. Download and upload data to and from the central station.

2.14 FIELD-PROCESSING HARDWARE

A. Alarm Annunciation Local Processor:

1. Respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station, and change outputs based on commands received from the central station.
2. Local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.
3. Local processor inputs shall monitor dry contacts for changes of state that reflect alarm conditions.
4. Local processor shall have at least eight alarm inputs which allow wiring contacts as normally open or normally closed for alarm conditions; and shall provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements.
5. Local processor shall report line supervision alarms to the central station.
6. Alarms shall be reported for any condition that remains abnormal at an input for longer than 500 milliseconds.
7. Alarm condition shall be transmitted to the central computer during the next interrogation cycle.
8. Local processor outputs shall reflect the state of commands issued by the central station.
9. Outputs shall be a form C contact and shall include normally open and normally closed contacts.
10. Local processor shall have at least four command outputs.

11. Local processor shall be able to communicate with the central station via RS-485 or TCP/IP as a minimum.

B. Processor Power Supply:

1. Local processor and sensors shall be powered from an uninterruptible power source.
2. Uninterruptible power source shall provide eight hours of battery back-up power in the event of primary power failure and shall automatically fully recharge the batteries within 12 hours after primary power is restored.
3. If the facility is without an emergency generator, the uninterruptible power source shall provide 24 hours of battery backup power.
4. There shall be no equipment malfunctions or perturbations or loss of data during the switch from primary to battery power and vice versa.
5. Batteries shall be sealed, non-outgassing type.
6. Power supply shall be equipped with an indicator for ac input power and an indicator for dc output power.
7. Loss of primary power shall be reported to the central station as an alarm.

C. Auxiliary Equipment Power: A GFI service outlet shall be furnished inside the local processor's enclosure.

D. Entry-Control Local Processor:

1. Entry-control local processor shall respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station, and change outputs based on commands received from the central station.
2. Local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.
3. Entry-control local processor shall provide local entry-control functions including communicating with field devices such as card readers, keypads, biometric personnel identity-verification devices, door strikes, magnetic latches, gate and door operators, and exit push buttons.
4. Processor shall also accept data from entry-control field devices as well as database downloads and updates from the central station that include enrollment and privilege information.
5. Processor shall send indications of successful or failed attempts to use entry-control field devices and shall make comparisons of presented information with stored identification information.
6. Processor shall grant or deny entry by sending control signals to portal-control devices and mask intrusion-alarm annunciation from sensors stimulated by authorized entries.
7. Entry-control local processor shall use inputs from entry-control devices to change modes between access and secure.
8. Local processor shall maintain a date-time- and location-stamped record of each transaction and transmit transaction records to the central station.
9. Processor shall operate as a stand-alone portal controller using the downloaded database during periods of communication loss between the local processor and the central station.
10. Processor shall store a minimum of 4000 transactions during periods of communication loss between the local processor and the central station for subsequent upload to the central station upon restoration of communication.
11. Local processor inputs shall monitor dry contacts for changes of state that reflect alarm conditions.

12. Local processor shall have at least eight alarm inputs which allow wiring contacts as normally open or normally closed for alarm conditions; and shall also provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements.
13. Local processor shall report line supervision alarms to the central station.
14. Alarms shall be reported for any condition that remains abnormal at an input for longer than 500 ms.
15. Alarm condition shall be transmitted to the central station during the next interrogation cycle.
16. Entry-control local processor shall include the necessary software drivers to communicate with entry-control field devices. Information generated by the entry-control field devices shall be accepted by the local processor and automatically processed to determine valid identification of the individual present at the portal.
17. Upon authentication of the credentials or information presented, the local processor shall automatically check privileges of the identified individual, allowing only those actions granted as privileges.
18. Privileges shall include, but are not limited to, time of day control, day of week control, group control, and visitor escort control. The local processor shall maintain a date-time- and location-stamped record of each transaction.
19. Transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
20. Local processor outputs shall reflect the state of commands issued by the central station.
21. Outputs shall be a form C contact and shall include normally open and normally closed contacts.
22. Local processor shall have at least four addressable outputs.
23. The entry-control local processor shall also provide control outputs to portal-control devices.
24. Local processor shall be able to communicate with the central station via RS-485 or TCP/IP as a minimum.
25. The system manufacturer shall provide strategies for downloading database information for panel configurations and cardholder data to minimize the required download time when using IP connectivity.

2.15 TIA 232-F ASCII INTERFACE SPECIFICATIONS

A. ASCII interface shall allow TIA 232-F connections to be made between the control station operating as the host PC and any equipment that will accept TIA 232-F ASCII command strings, such as CCTV switches, intercoms, and paging systems.

1. Alarm inputs in system shall allow for individual programming to output up to four unique ASCII character strings through two different COM ports on the host PC.
2. Inputs shall have the ability to be defined to transmit a unique ASCII string for alarm and one for restore through one COM port, and a unique ASCII string for a nonalarm, abnormal condition and one for a normal condition through the same or different COM port.
3. Predefined ASCII character strings shall have the ability to be up to 420 characters long with full use of all the ASCII control characters, such as return or line feed. Character strings shall be defined in the system database and then assigned to the appropriate inputs.

4. COM ports of the host PC used to interface with external equipment shall be defined in the setup portion of the software. COM port's baud rate, word length, stop bits, and parity shall be definable in the software to match that of the external equipment.

B. Pager-System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.

1. TIA 232-F output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent to the paging system. This interface shall support both numeric and alphanumeric pagers.

C. Alarm-System Interface:

1. TIA 232-F output shall be capable of transmitting alarms from other monitoring and alarm systems to central-station automation software.
2. Alternatively, alarms that are received by this access-control system are to be transferred to the alarm automation system as if they were sent through a digital alarm receiver.

a. System shall be able to transmit an individual message from any alarm input to a burglar-alarm automation monitoring system.
b. System shall be able to append to each message a predefined set of character strings as a prefix and a suffix.

2.16 CABLES

A. General Cable Requirements: Comply with requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security" and as recommended by system manufacturer for integration requirement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. Record setup data for control station and workstations.
2. For each Location, record setup of controller features and access requirements.
3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
4. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
5. Assign action message names and compose messages.
6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
7. Prepare and install alarm graphic maps.
8. Develop user-defined fields.
9. Develop screen layout formats.
10. Discuss badge layout options; design badges.
11. Complete system diagnostics and operation verification.
12. Prepare a specific plan for system testing, startup, and demonstration.
13. Develop acceptance test concept and, on approval, develop specifics of the test.

D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and fiber-optic rating of components, and that ensure Category 6 and fiber-optic performance of completed and linked signal paths, end to end.

F. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.4 CABLE APPLICATION

A. Comply with TIA 569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. TIA 232-F Cabling: Install at a maximum distance of 50 ft. (15 m).

D. TIA 485-A Cabling: Install at a maximum distance of 4000 ft. (1220 m).

E. Card Readers and Keypads:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft. (75 m), and install No. 20 AWG wire if maximum distance is 500 ft. (150 m).
3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed **250 ft. (75 m)**.

G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of **25 ft. (8 m)**.

3.5 GROUNDING

A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:

1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
2. Bus: Mount on wall of main equipment room with standoff insulators.
3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 INSTALLATION

A. Push Buttons: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- (6.4-mm-) high text and symbols as required. Push-button switches shall be connected to the controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric bolt, or other facility release device.

B. Install card readers, keypads, push buttons, and biometric readers.

3.7 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA 606-A.

B. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

D. At completion, cable and asset management software shall reflect as-built conditions.

3.8 SYSTEM SOFTWARE AND HARDWARE

A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.9 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. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial

Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.

2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured with an activated burglar alarm and access-control system reporting to a central station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain security access system. See Division 01 Section "Demonstration and Training."

B. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Security personnel.
3. Hardware maintenance personnel.

END OF SECTION 28 13 00

SECTION 28 16 00 - INTRUSION DETECTION

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. Intrusion detection with communication links to perform monitoring, alarm, and control functions.

2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for cabling between master control units and field-mounted devices and control units.

1.3 DEFINITIONS

A. PIR: Passive infrared.

B. RFI: Radio-frequency interference.

C. Control Unit: System component that monitors inputs and controls outputs through various circuits.

D. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

E. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

F. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

G. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes.

H. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

I. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.

J. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 SUBMITTALS

A. Product Data: Components for sensing, detecting, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify control interface devices and media to be used. Describe characteristics of network and other data communication lines.

a. Indicate methods used to achieve systems integration.

b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.

c. Describe characteristics of network and other data communication lines.

d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.

2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.

3. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building.

4. Master Control-Unit Console Layout: Show required artwork and device identification.

5. Device Address List: Coordinate with final system programming.

6. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.

7. Details of surge-protection devices and their installation.

8. Sensor detection patterns and adjustment ranges.

C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required.

F. Qualification Data: For Installer.

G. Field quality-control reports.

H. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.

2. Master control-unit hardware and software data.

I. Warranty: Sample of special warranty.

J. Other Information Submittals:

1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.

2. Examination reports documenting inspections of substrates, areas, and conditions.

3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.

2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

D. 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.

E. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

F. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.

G. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 4000 feet (1220 m).

2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.

3. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.

4. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambients of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.

5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 12 inches (305 mm) thick.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.8 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. Intrusion Detection Devices: Furnish one of each type.

2. Fuses: Three of each kind and size.

3. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.

4. Security Fasteners: Furnish no fewer than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.

2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.

3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.

C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

D. System Control: Master control unit shall directly monitor intrusion detection devices and connecting wiring in a multiplexed distributed control system or as part of a network.

E. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

F. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.

2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.

3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.

4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.

5. Protected Zone Test: Initiate operational test of a specific protected zone.

6. System Test: Initiate system-wide operational test.

7. Print reports.

G. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

H. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.

I. Response Time: Two seconds between actuation of any alarm and its indication at master control unit.

J. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

K. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

L. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Division 08 Section "Door Hardware."

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."

2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

C. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

F. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

G. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

H. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

I. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.

2.3 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Exterior Electronics: NEMA 250, Type 4X, fiberglass.

D. Corrosion Resistant: NEMA 250, Type 4X, stainless steel.

E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.:

B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 DOOR AND WINDOW SWITCHES

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

C. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

D. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounted magnet and floor-mounted switch unit.

E. Remote Test: Simulate movement of actuating magnet from master control unit.

2.6 PIR SENSORS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

C. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

1. Wall-Mounted Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet (15 m).

2. Ceiling-Mounted Unit Spot-Detection Pattern: Full 360-degree conical.

3. Ceiling-Mounted Unit Pattern Size: 84-inch (2135-mm) diameter at floor level for units mounted 96 inches (2440 mm) above floor; 18-foot (5.5-m) diameter at floor level for units mounted 25 feet (7.6 m) above floor.

D. Device Performance:

1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.

2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.

3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.7 MICROWAVE INTRUSION DETECTORS (INTERIOR)

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.

1. Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.

2. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.

3. Remote Test: When initiated by master control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

2.8 ACOUSTIC-TYPE, GLASS-BREAK SENSORS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.

C. Device Performance: Detect unique, airborne acoustic energy spectrum caused by breaking glass.

1. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot (6-m) range.

2. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).

3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor control unit[or at master control unit].

4. Control Unit: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.

5. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

2.9 SECURITY FASTENERS

A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.

B. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

C. Drive System Types: Pinned Torx or pinned hex (Allen).

D. Socket Flat Countersunk Head Fasteners:

1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).

2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.

E. Socket Button Head Fasteners:

1. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).

2. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.

F. Socket Head Cap Fasteners:

1. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).

2. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.

G. Protective Coatings for Heat-Treated Alloy Steel:

1. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.

2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

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 intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.

2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

A. Integrate intrusion detection system with the following systems and equipment:

1. Electronic door hardware.

3.3 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

D. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.

2. Connect new equipment to existing monitoring equipment at the Supervising Station.

3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

E. Security Fasteners: Where accessible to inmates, install intrusion detection components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless steel security fasteners in stainless steel materials.

3.4 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Division 26 Section "Raceway and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.

2. 120-V Power Wiring: Install according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Division 28 Section "Conductors and Cables for Electronic Safety and Security."

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

F. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Division 26 Section "Identification for Electrical Systems."

B. Install instructions frame in a location visible from master control unit.

3.6 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.7 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Testing Agency: System vendor will engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. 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.

E. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

F. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

G. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION 28 16 00

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SECTION 28 23 00 - VIDEO SURVEILLANCE

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 a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. B/W: Black and white.

C. CCD: Charge-coupled device.

D. FTP: File transfer protocol.

E. IP: Internet protocol.

F. LAN: Local area network.

G. MPEG: Moving picture experts group.

H. NTSC: National Television System Committee.

I. PC: Personal computer.

J. PTZ: Pan-tilt-zoom.

K. RAID: Redundant array of independent disks.

L. TCP: Transmission control protocol - connects hosts on the Internet.

M. UPS: Uninterruptible power supply.

N. WAN: Wide area network.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. 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. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.

4. Wiring Diagrams: For power, signal, and control wiring.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

D. Seismic Qualification Certificates: For video surveillance, cameras, camera-supporting equipment, 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.

E. Field quality-control reports.

F. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

G. Warranty: Sample of special warranty.

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. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 4 enclosures.
4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 12 inches (305 mm) thick. Use NEMA 250, Type 4 enclosures.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits." as recommended by manufacturer for type of line being protected.

C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 STANDARD CAMERAS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. B/W Camera:

1. Comply with UL 639.
2. Pickup Device: CCD interline transfer, 252,000 pixels.
3. Horizontal Resolution: 380 lines.
4. Signal-to-Noise Ratio: Not less than 46 dB.
5. With AGC, manually selectable on or off.
6. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 1 footcandle.
7. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
8. Manually selectable modes for backlight compensation or normal lighting.
9. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
10. Motion Detector: Built-in digital.

C. Color Camera:

1. Comply with UL 639.
2. Pickup Device: CCD interline transfer, 380,000 pixels.
3. Horizontal Resolution: 480 lines.
4. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.
5. With AGC, manually selectable on or off.
6. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 1 footcandle.
7. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.

8. Manually selectable modes for backlight compensation or normal lighting.
9. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
10. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
11. Motion Detector: Built-in digital.

D. Automatic Color Dome Camera: Assembled and tested as a manufactured unit, containing dome assembly, color camera, motorized pan and tilt, zoom lens, and receiver/driver.

1. Comply with UL 639.
2. Pickup Device: CCD interline transfer, 380,000 pixels.
3. Horizontal Resolution: 480 lines.
4. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.
5. With AGC, manually selectable on or off.
6. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 1 footcandle.
7. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
8. Manually selectable modes for backlight compensation or normal lighting.
9. Pan and Tilt: Direct-drive motor, 360-degree rotation angle, and 180-degree tilt angle. Pan-and-tilt speed shall be controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.
10. Preset Positioning: Eight user-definable scenes, each allowing 16-character titles. Controls shall include the following:
    a. In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
    b. Motion detection shall be available at each camera position.
    c. Up to four preset positions may be selected to be activated by an alarm. Each of the alarm positions may be programmed to output a response signal.
11. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
12. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
13. Motion Detector: Built-in digital.
14. Dome shall support multiplexed control communications using coaxial cable recommended by manufacturer.

2.3 POWER SUPPLIES

A. Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera, infrared illuminator, and lens.

1. Enclosure: NEMA 250, Type 4.

2.4 INFRARED ILLUMINATORS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Description: Lighting fixtures that emit light only in the infrared spectrum, suitable for use with cameras indicated, for nighttime surveillance, without emitting visible light.

1. Field-Selectable Beam Patterns: Narrow, medium, and wide.
2. Rated Lamp Life: More than 8000 hours.
3. Power Supply: 120-VAC.

C. Area Coverage: Illumination to 150 feet (50 m) in a narrow beam pattern.

D. Exterior housings shall be suitable for same environmental conditions as the associated camera.

2.5 CAMERA-SUPPORTING EQUIPMENT

A. Pan Units: Motorized automatic-scanning units arranged to provide remote-controlled manual and automatic camera panning action, and equipped with matching mounting brackets.

1. Scanning Operation: Silent, smooth, and positive.
2. Stops: Adjustable without disassembly, to limit the scanning arc.

B. Pan-and-Tilt Units: Motorized units arranged to provide remote-controlled aiming of cameras with smooth and silent operation, and equipped with matching mounting brackets.

1. Panning Rotation: 0 to 355 degrees, with adjustable stops.
2. Tilt Movement: 90 degrees, plus or minus 5 degrees, with adjustable stops.
3. Speed: 12 degrees per second in both horizontal and vertical planes.
4. Wiring: Factory prewired for camera and zoom lens functions and pan-and-tilt power and control.

5. Built-in encoders or potentiometers for position feedback.

6. Pan-and-tilt unit shall be available with preset positioning capability to recall the position of a specific scene.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Protective Housings for Fixed and Movable Cameras: Steelenclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.

1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display. Tamper switches and central-control unit are specified in Division 28 Section "Intrusion Detection."
2. Camera Viewing Window: Polycarbonate window, aligned with camera lens.
3. Duplex Receptacle: Internally mounted.
4. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
5. Sun shield shall not interfere with normal airflow around the housing.

6. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
7. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.
8. Enclosure Rating: NEMA Type 4.

2.6 MONITORS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Recording Monitor:

1. Metal cabinet units designed for continuous operation.
2. Screen Size (Diagonal Dimension): Minimum 24 inches.
3. Horizontal Resolution: [300] <Insert resolution> lines.
4. Minimum Front Panel Devices and Controls: Power switch; power-on indicator; and brightness, contrast, color, and tint controls.
5. Degaussing: Automatic.
6. Electrical: 120-V ac, 60 Hz.

2.7 DIGITAL VIDEO RECORDERS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Description: Digital, time-lapse type, full-frame and motion recorder, with removable hard drive.

1. Recording Time: 400 hours minimum.
2. Resolution: 720 by 480 lines, minimum.
3. Programming shall be from trackball and push buttons on face of the recorder, settings shall be displayed on any video monitor connected to the recorder. Programming shall include the following:
    a. Motion analysis graph.
    b. Password protection.
    c. Alarm and timer controls.
    d. Continuous recording option.
    e. Time-lapse operating modes.
    f. Search video by time, event, or motion.
4. Programming: SmartMedia card for software updating, image archiving, and image transfer to a PC.
5. Storage: 80-GB, removable hard drive. Software shall permit hot-swapping drives.
6. Compression: MPEG-2.
7. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
8. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
9. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

2.8 IP VIDEO SYSTEMS

A. Manufacturers: Products shall be from the same manufacturer as the existing campus system.

B. Description:

1. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
2. System shall have seamless integration of all video surveillance and control functions.
3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
6. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
7. Encoder/decoder combinations shall place video, audio, and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
8. All system interconnect cables, workstation PCs, PTZ joysticks, and network intermediate devices shall be provided for full performance of specified system.

2.9 SIGNAL TRANSMISSION COMPONENTS

A. Cable: Coaxial cable elements have 75-ohm nominal impedance. Comply with requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

B. Video Surveillance Coaxial Cable Connectors: BNC type, 75 ohms. Comply with requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Install cables in raceways unless otherwise indicated.

1. Conceal raceways and wiring except in unfinished spaces.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. 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.

E. For LAN connection and fiber-optic and copper communication wiring, comply with Division 27 Sections "Communications Backbone Cabling" and "Communications Horizontal Cabling."

F. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras and infrared illuminators level and plumb.

B. Install cameras with 84-inch- (2134-mm-) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

D. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

E. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

F. Avoid ground loops by making ground connections only at the control station.

1. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.

G. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: System vendor will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

    a. Prepare equipment list described in "Submittals" Article.
    b. Verify operation of auto-iris lenses.
    c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
    d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
    e. Set and name all preset positions; consult Owner's personnel.
    f. Set sensitivity of motion detection.
    g. Connect and verify responses to alarms.
    h. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. Video surveillance system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. 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. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.

5. Provide a written report of adjustments and recommendations.

3.6 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

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SECTION 28 31 11 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.0 EXISTING SYSTEM

A. Existing campus network uses Simplex 4010ES fire alarm control unit. All new work installed shall be as an extension of the existing campus system.

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. System printer.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

C. SLC: Signalling Line Circuit

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

A. 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.

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

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 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. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. 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.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

H. NFPA Certification: Obtain certification according to NFPA 72 by <Insert certification agency>.

1.8 PROJECT CONDITIONS

A. 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 two 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.

1.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 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. Lamps for Remote Indicating Lamp Units: 1.
2. Lamps for Strobe Units: Quantity equal to 5.
3. Smoke Detectors, Heat Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.

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. Carbon Monoxide detectors.
5. Natural Gas detectors.
6. Duct smoke detectors.
7. Verified automatic alarm operation of smoke detectors.
8. Automatic sprinkler system water flow.
9. Heat detectors in elevator shaft and pit.
10. Fire-extinguishing system operation.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm 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. Activate emergency shutoffs for gas and fuel supplies.
11. Record events in the system memory.
12. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

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 primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.

8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

    a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), 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.

2. Addressable initiation devices that communicate device identity and status.

    a. Smoke sensors shall additionally communicate sensitivity setting.
    b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 2 line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Signaling Line Circuits: NFPA 72, Class A.
2. Notification Appliances: NFPA 72, Class B.
3. Install no more than 50 devices on any single circuit.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.

    a. Elevator lobby detectors.
    b. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Heat detector in an elevator shaft shall shut down elevators associated with the location without time delay.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

H. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.

    a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

I. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals 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.

K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod, 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.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
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.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 135 deg F (57 deg C).

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.

2.7 CARBON MONOXIDE DETECTORS

A. General Requirements for Carbone Monoxide Detectors: Comply with UL 2034.

B. Carbon monoxide detector shall have integrated “sounder” alarm base.

2.8 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) 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: Factory finished, red.

G. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.

2. Mounting: surface mounted.
3. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.9 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.10 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

2.11 CONDUCTORS AND CABLES

A. SLC: System manufacturer’s recommended cabling.

B. Notification Loop: No less than 14 American Wire Gauge. Provide end-of-line resistor as recommended by system manufacturer.

C. Network Cables: All telecommunications cables associated with the fire alarm network shall comply with Division 27 Section “Communications Horizontal Cabling’

D. Raceways: All fire alarm cables shall be in conduit. Conduit shall comply with Division 26 Section “Raceway and Boxes for Electrical Systems”

1. All fire alarm conduit shall be painted red. Factory-finish or field painting is permitted.

2.12 ANCILLARY EQUIPMENT

A. Provide all monitor modules, relay modules, and interconnecting devices necessary for a complete and operable system.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

D. Smoke- or Heat-Detector Spacing:

1. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
2. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

F. Remote Status and Alarm Indicators: Install near each duct smoke detector.Coordinate first paragraph below with Drawings.

G. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Alarm-initiating connection to elevator recall system and components.
3. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
4. Supervisory connections at valve supervisory switches.
5. Supervisory connections at elevator shunt trip breaker.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

C. All conduit for fire alarm system shall be painted red. Factory-applied finish or field painting are acceptable.

3.4 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.

3.5 FIELD QUALITY CONTROL

A. Field tests may be witnessed by owner’s representative at sole discretion of owner.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

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 NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "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 of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11

SECTION 31 10 00 - 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. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities, abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:
1. Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically 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 and is 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 more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other 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.

1.5 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 videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Dig Safe System 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. 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.

E. Do not direct vehicle or equipment exhaust towards protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

1. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches (1372 mm) above the ground.

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.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

B. Removal of underground utilities is included in Division 02, Division 22, Division 26, and Division 33 Sections.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and stockpile in areas approved by Architect.

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 (200 mm), 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 of 6 inches (150 mm) 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 more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

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SECTION 31 20 11 - EARTH MOVING (SHORT FORM)

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Owner's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in AASHTO T99 Method A. ASTM D698 Method A.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

B. Classified Excavation: Removal and disposal of all material not defined as rock.

C. Rock Excavation:

1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m3 (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
3. Boulders or other detached stones each having a volume of 0.4 m3 (1/2 cubic yard) or more.

1.5 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:

1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.
3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment: No separate payment shall be made for rock excavation except as noted in the Design Build Agreement.

1.6 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

C. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).
2. Warning Tape: 12 inches (300 mm) long; of each color.

D. Qualification Data: For qualified testing agency.

E. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

F. Rock Excavation Report:

1. Certification of rock quantities excavated.
2. Excavation method.
3. Labor.
4. Equipment.
5. Land Surveyor's or Civil Engineer's name and official registration stamp.
6. Plot plan showing elevations.

G. Furnish to Owner, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Nursery and Landscape Association (ANLA):

2004 ..... American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):

T99-01 (R2004)..... Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-01 (2004) ..... Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):

D698-07 ..... Laboratory Compaction Characteristics of Soil Using Standard Effort

D1557-02 ..... Laboratory Compaction Characteristics of Soil Using Modified Effort

E. Standard Specifications of (Insert name of local state) State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:

1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4).
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

C. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the Owner. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the project..

B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and 2250 mm (7’-6”) of utility lines if such removal is approved in advance by the Owner. Remove materials from the project. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including the roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Building materials shall not be stored closer to trees and shrubs, that are to remain, than the farthest extension of their limbs.

D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the Owner. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

1. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs.

Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the project.

E. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support in compliance with Specification Section 31 23 23.33, FLOWABLE FILL, under disturbed foundations, as directed by Owner, at no additional cost to the Owner. Do not remove shoring until permanent work in excavation has been inspected and approved by COTR.

B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from Owner. Approval by the Owner is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the Owner should be contacted to consider the use of flowable fill.

C. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft material to solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
3. Do not tamp earth for backfilling in footing bottoms, except as specified.

D. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
   a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
   b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.
   c. Support piping on undisturbed earth unless a mechanical support is shown.
   d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the Owner.

E. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials, that are determined by the Owner as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the Owner, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on meters (yardage) in cut section only.

G. Finished elevation of subgrade shall be as follows:

1. Pavement Areas - bottom of the pavement or base course as applicable.
2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by Owner.

B. Proof-rolling Existing Subgrade: Proof-roll with a fully loaded dump truck. Make a minimum of one pass in each direction. Remove unstable uncompactable material and replace with granular fill material completed to mix requirements specified.

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the Owner. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with the following test method AASHTO T99 Method A ASTM D698.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the Owner at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by Owner before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

F. Watering: The Owner is responsible for having adequate water available at the site. As sodding is completed in any one section, the entire sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. Owner will be responsible for sod after installation and acceptance.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the Owner from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the project.

END OF SECTION 31 20 11

SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Sections:

1. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

1.3 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. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For qualified Installer, land surveyor and professional engineer.

D. Field quality-control reports.

E. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to dewatering including, but not limited to, the following:
   a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
   b. Geotechnical report.
   c. Proposed site clearing and excavations.
   d. Existing utilities and subsurface conditions.
   e. Coordination for interruption, shutoff, capping, and continuation of utility services.
   f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   g. Testing and monitoring of dewatering system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining 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.

PART 2 - PRODUCTS (Not Used)

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 and 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. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION

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. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient

dewatering equipment to 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.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches (600 mm) below surface of excavation.

E. 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. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. 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. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. 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 (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers 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 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. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 31 23 19

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving overlay.
4. Asphalt surface treatments.
5. Pavement-marking paint.

1.3 DEFINITIONS

A. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.

1. Standard Specification: Per latest NYS D.O.T. Standards.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by the DOT of the state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with D.O.T of State of New York for asphalt paving work.

D. Asphalt-Paving Publication: Comply with New York State D.O.T, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

E. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
2. Review condition of subgrade and preparatory work.
3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if sub-grade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

C. Fine Aggregate: Per New York State D.O.T, sharp-edged natural sand or sand prepared from stone, gravel, properly 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.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Per New York State D.O.T. Type 3.

B. Asphalt Cement: Per New York State D.O.T.

C. Prime Coat: Asphalt emulsion prime complying with New York State D.O.T. requirements.

D. Tack Coat: Emulsified asphalt or cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application per New York State D.O.T.

2.3 AUXILIARY MATERIALS

A. Sand: ASTM D 1073, Grade Nos. 2 or 3.

B. Joint Sealant: New York State D.O.T. approved, hot-applied, single-component, polymer-modified bituminous sealant.

C. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with New York State D.O.T.

1. Color: White, Yellow or Blue As indicated.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes designed according to procedures in New York State D.O.T. Composition, "Composition of Hot Mix Asphalt Mixtures."

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

2. Provide mixes complying with composition, grading, and tolerance requirements in New York State D.O.T. for the following nominal, maximum aggregate sizes:

a. Base Course: Type 1
b. Binder Course: Type 3
c. Shim Course: Type 5
d. Top Course: Type 7

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that sub-grade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll sub-base using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new sub-grade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving 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.

C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

C. 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 PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to 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. Tack coat existing asphalt or concrete surfaces and allow tack coat to cure undisturbed.
2. Place hot-mix asphalt base course in number of lifts and thicknesses not to exceed 2 inches.
3. Spread mix at 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. 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 vibratory-plate compactors in areas inaccessible to rollers. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
6. Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness.
7. 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 92 percent of reference maximum theoretical density according to ASTM D 2041.

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. Complete a section of asphalt base course before placing asphalt surface course.

C. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

D. 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.

E. Remove and restore paved areas that are defective or contaminated.

F. Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

G. Apply pavement-marking paint with mechanical equipment to a minimum wet film thickness of 15 mils (0.4 mm).

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 as described in D.O. T. Standards.
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 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: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

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. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base and Binder Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base 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 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with airport Facilities Director.

B. Allow paving to age for 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.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to New York State D.O.T. Standards.

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 according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

A. Remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Design mixtures for concrete.

B. Comply with ACI 301, "Specification for Structural Concrete."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Welded Wire Reinforcement: ASTM A 185, flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60), deformed.

C. Portland Cement: ASTM C 150, Type I or II

D. Fly Ash: ASTM C 618, Type C or F.

E. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source.

F. Air-Entraining Admixture: ASTM C 260.

G. Chemical Admixtures: ASTM C 494. Calcium chloride shall not be used.

H. Synthetic Fiber: ASTM C 1116, Type III, polypropylene fibers, 1/2 to 1-1/2 inches (13 to 38 mm) long.

I. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

J. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

K. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable and resistant to lime and other alkalis.

L. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery.

2.2 CONCRETE MIXTURES

A. Proportion normal-weight concrete mixes to provide the following properties:

1. Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm), at point of placement.
3. W/C Ratio: 0.45 maximum at point of placement.

4. Air Content: 6 percent plus or minus 1.5 percent.
5. Synthetic Fiber: 1.0 lb/cu. yd. (0.60 kg/cu. m)

2.3 DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Surfaces Inc.
   b. Matcrete Precision Stamped Concrete Tools.
   c. Southern Color N.A., Inc.
   d. Stampcrete International Ltd.
   e. Superior Decorative by Dayton Superior.

Size of Stamp: One piece 24 by 48 inches (610 by 1220 mm)

PART 3 - EXECUTION

3.1 PAVING

A. Accurately position and support reinforcement, and secure against displacement.

B. Locate and install contraction, construction, isolation, and expansion joints as indicated or required.

C. Place concrete in a continuous operation within planned joints or sections. Do not add water to adjust slump.

D. Float surfaces to true planes within a tolerance of 1/4 inch in 10 feet (1:480) and medium-to-coarse-textured broom finish.

E. Tool edges and joints to a radius of 3/8 inch (9.5 mm).

F. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.

G. Begin curing after finishing concrete. Keep concrete continuously moist for at least seven days.

H. Apply traffic paint with mechanical equipment to a minimum wet film thickness of 15 mils (0.4 mm).

I. Owner will employ a testing agency to sample concrete, perform tests, and submit test reports during concrete placement.

J. Remove and replace concrete paving that is broken, damaged, or defective. Exclude traffic from paving for at least 14 days.

END OF SECTION 32 13 13

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product certificates and planting schedule.

B. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

C. Planting Restrictions: Plant during one of the following periods.

1. Spring Planting: May 15 or later
2. Fall Planting: Before November 1

D. Maintain trees and shrubs until established, but not less than twelve (12) months.

E. Maintain ground covers and plants until established, but not less than six (6) months.

PART 2 - PRODUCTS

2.1 PLANTING MATERIALS

A. Tree and Shrub Material: Nursery grown, with healthy root systems, well shaped, fully branched, healthy, and free of insects, eggs, larvae, defects, and disfigurement.

1. Provide balled and potted or fabric bag-grown trees and shrubs.

B. Ground Covers and Plants: Established and well rooted in pots or similar containers.

2.2 SOIL AND AMENDMENTS

A. Topsoil: ASTM D 5268, free of stones 1 inch (25 mm) or larger.

B. Lime: ASTM C 602, Class T, agricultural limestone.

C. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8.

D. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

E. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

F. Bonemeal: Commercial, raw, finely ground; minimum of [**1**] [**4**] percent nitrogen and [**10**] [**20**] percent phosphoric acid.

G. Commercial Fertilizer: Commercial-grade complete fertilizer, consisting of 1 lb/1000 sq. ft. (0.5 kg/100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

H. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium; 5 percent nitrogen; 10 percent phosphorous; and 5 percent potassium; by weight.

I. Organic Mulch: Shredded hardwood

J. Mineral Mulch: Marble chips

1. Size Range: [1-1/2 inches (38 mm) maximum, 3/4 inch (19 mm) minimum]
2. Color: Readily available natural gravel color range

K. Weed-Control Barrier: Polypropylene or polyester nonwoven fabric.

2.3 MISCELLANEOUS

A. Edgings: Black polyethylene or vinyl not less than 4 inches (102 mm) deep, with accessories and stakes.

1. Products:
   a. Expert Edge or approved equal.

2.4 PLANTING SOIL MIX

A. Mix topsoil with the following soil amendments in the following quantities:

1. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m): 50 lbs.
2. Ratio of Loose Compost to Topsoil by Volume: 1:4.
3. Ratio of Loose Peat to Topsoil by Volume: 1:4
4. Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:12
5. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m): 50 lbs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Planting Bed Establishment: Loosen subgrade to a depth of 6 inches (150 mm). Remove stones sticks, roots, and rubbish. Spread planting soil mixture to a depth of 6 inches (150 mm), but not less than required to meet finish grades. Work first layer into top of loosened subgrade.

B. Trees and Shrubs: Excavate pits with sides sloped inward and with bottom of excavation slightly raised at center to assist drainage. Excavate approximately three times as wide as ball diameter. Scarify sides of plant pit smeared or smoothed during excavation.

1. Set trees and shrubs plumb and in center of pit with top of ball 1 inches (25 mm) above adjacent finish grades.
2. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Carefully remove root balls from containers without damaging

root ball or plant. Do not use planting stock if ball is cracked or broken before or during planting operation.

3. Place planting soil mix around ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Water again after placing and tamping final layer of planting soil mix.
4. Prune, thin, and shape trees and shrubs after planting.

C. Plant ground cover and plants as indicated. Dig holes large enough to allow root spread. Plant stock working soil around roots and leave a slight saucer around plants to hold water. Water after planting. Do not cover plant crowns with wet soil.

D. Mulching: Before mulching, install weed-control barriers. Apply mineral mulch, 2 inches (50 mm) thick, and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

E. Edgings: Install edgings and anchor with stakes driven below top elevation of edging.

F. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting and repairing, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

G. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

END OF SECTION 32 93 00

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SECTION 33 05 00 - 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. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Piped utility demolition.
8. Piping system common requirements.
9. Equipment installation common requirements.
10. Painting.
11. Concrete bases.
12. Metal supports and anchorages.

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.

C. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. fittings.
2. Pipe.
3. Identification.
4. Fill Material.
5. Concrete Mix

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
2. PVC to ABS Piping Transition: ASTM D 3138.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cascade Waterworks Mfg. Co.
   b. Dresser, Inc.; DMD Div.
   c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.
3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Spears Manufacturing Co.
3. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Colonial Engineering, Inc.
   b. NIBCO INC.
   c. Spears Manufacturing Co.
3. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Hart Industries, International, Inc.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Div.
3. Description: Factory fabricated, union, NPS 2 and smaller.
   a. Pressure Rating: 150 psig minimum at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Water Technologies, Inc.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
   a. Pressure Rating: 150 psig minimum
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange 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 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: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
   a. Pressure Rating: 150 psig minimum
   b. Gasket: Neoprene or phenolic.
   c. Bolt Sleeves: Phenolic or polyethylene.
   d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

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 manufacturers. Subject to compliance with requirements, provide products by one of the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
   a. Pressure Rating: 300 psig at 225 deg F.
   b. End Connections: Threaded.

F. Dielectric Nipples:
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 manufacturers. Subject to compliance with requirements, provide products by one of the following:
   a. Perfection Corporation.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Company.
2. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
   a. Pressure Rating: 300 psig at 225 deg F
   b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Fiberboard or Brass.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch thick, polished brass or aluminum.
2. Material: 0.0375-inch thick stainless steel.
3. Material: 3/32-inch thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.

6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples
2. NPS 2-1/2 to NPS 4: Dielectric nipples.
3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12: Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

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 to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. 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 (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components in accordance with manufacturer's recommendations or per applicable Codes. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.

2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.

3. Locate pipe markers on exposed piping according to the following:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    d. At manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4-inch-high for name of unit if viewing distance is less than 24 inches, 1/2-inch-high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section Cast-in-Place Concrete

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 33 05 00

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Coordination Drawings showing piping profiles and elevations at a horizontal scale of 1 inch equals 50 feet (1:500) and a vertical scale of 1 inch equals 5 feet (1:50). Indicate underground structures and show pipe types, sizes, and materials and elevations of other utilities crossing system piping.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Bell-and-spigot ends and gasketed joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant
2. Class I, Wall A

B. Corrugated PE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form soiltight joints.

C. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller ASTM D 3034, SDR 35, for gasketed joints. Include ASTM F 477 elastomeric-seal gaskets.

D. Special Pipe Couplings and Fittings: Rubber or elastomeric sleeve and band assembly fabricated to match OD of pipes to be joined, for nonpressure joints.

2.2 UTILITY STRUCTURES

A. Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading, with provision for rubber sealant joints.

1. Joint Sealants: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
2. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch (150- to 229-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
3. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches (1500 mm).

4. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
5. Include 24-by-24-inch- (610-by-610-mm-) minimum flat grate with small square or short-slotted drainage openings.

B. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

C. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all surfaces, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream.

B. Install piping pitched at minimum slope of 1 percent and 36-inch (1000-mm) minimum cover, unless otherwise indicated.

C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install PE pipe and fittings according to ASTM D 2321. Join pipe, tubing, and fittings with couplings for soiltight joints according to manufacturer's written instructions. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

E. Install PVC pipe and gasketed fittings with gaskets according to ASTM D 2321.

END OF SECTION 33 41 00

SECTION 33 46 00 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, with band type couplings.
B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.2 SOLID-WALL PIPES AND FITTINGS

A. PE Drainage Tubing and Fittings: AASHTO M 252, Interim, Type S, corrugated, with smooth waterway, and AASHTO M 252 corrugated, band-type fittings.
B. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, with ASTM F 477 elastomeric gaskets.

2.3 ACCESSORIES

A. Special Pipe Couplings: ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, with corrosion-resistant metal tension band and tightening mechanism on each end.

    1. Sleeve for Cast-Iron Soil Pipes: ASTM C 564, rubber.
    2. Sleeve for Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    3. Sleeve for Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.
C. Geotextile: Nonwoven or woven fabric of polyolefin or polyester fibers, or combination of both.
D. Soil Materials: Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Foundation Drainage Installation:

1. Place and compact impervious fill at least 6 inches (150 mm) deep and 12 inches (300 mm) wide on subgrade adjacent to bottom of footing.
2. Place compacted layer of drainage course at least 4 inches (100 mm) deep over compacted subgrade where drainage pipe is to be laid.
3. Encase pipe with sock-style geotextile filter fabric and install pipe.
4. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
5. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.
6. Fill to Grade: Place and compact impervious fill material over compacted drainage fill.

B. Install piping beginning at low points of system at a minimum slope of 0.5 percent. Bed piping with full bearing in filtering material.
C. Testing: Test drain piping with water to ensure free flow before backfilling.
D. Maintain swab or drag in piping with tight joints and pull past each joint as it is completed.

END OF SECTION 33 46 00