PLANNING · ARCHITECTURE · ENGINEERING · CONSTRUCTION · ENERGY

Specifications for:

Clinton-Graceville-Beardsley Schools

2025 Addition & Renovations

Bid Package BP-CGB-ADD-REN-25

VOLUME 1 OF 2 – DIVISION 00 THROUGH DIVISION 12

712 East 3rd Street
Gracville, MN 56240

PROGRAM CONSTRUCTION MANAGER

SitelogIQ, Inc.
7900 West 78th Street, Suite 400
Edina, MN 55439
Telephone: 952-297-8077

DATE OF ISSUE: DECEMBER 18, 2024

PLANNING · ARCHITECTURE · ENGINEERING · CONSTRUCTION · ENERGY

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VOLUME 2 OF 2 DIVISIONS 21– 33

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SECTION 000101 – PROJECT DIRECTORY

Project: **Clinton-Graceville Beardsley Schools**
2025 Addition & Renovations
712 East 3rd Street
Gracville, MN 56240

OWNER

Clinton-Graceville Beardsley District 2888
601 1st Street
Clinton, MN 56225
Contact: Brad Kelvington

ARCHITECT

DesignArc Group
434 5th Street, Suite 1
Brookings, SD 57006
Telephone: (605) 692-4008
Contact: Les Rowland
E-mail: les@designarcgroup.com

MECHANICAL ENGINEER

EDI Dolejs, Inc.
624 North Riverfront Drive
Mankato, MN 56001
Telephone: (507) 625-7869
Contact: Michael Dolejs
E-mail: mdolejs@edi-dolejs.com

CIVIL ENGINEER

Banner Associates Inc.
3900 North Northview Avenue
Sioux Falls, SD 57107
Telephone: (605) 696-9161
Contact: Neil Eichstadt
E-mail: neile@bannerassociates.com

PROGRAM CONSTRUCTION MANAGER

SitelogIQ, Inc.
7900 West 78th Street, Suite 400
Edina, MN, 55439
Telephone: (701) 671-0194
Contact: Darin Klein
E-mail: darin.klein@sitelogiq.com

STRUCTURAL ENGINEER

Albertson Engineering, Inc.
201 S. Monroe St. Suite 203A
Winner, SD 57580
Telephone: (605) 343-9606
Contact: Blake Tideman
E-mail: blaket@albertsonengineering.com

ELECTRICAL ENGINEER

EDI Dolejs, Inc.
1624 North Riverfront Drive
Mankato, MN 56001
Telephone: (507) 625-7869
Contact: Dusty Cole
E-mail: dcole@edi-dolejs.com

ROOFING CONSULTANT

TREMCO Inc.
3735 Green Road
Beachwood, OH 44122
Telephone: (612) 991-6995
Contact: Brandon Klukow
E-mail: bklukow@tremcoinc.com

END OF SECTION 000101

CLINTON-GRACEVILLE-BEARDSLEY SCHOOLS
2025 ADDITION & RENOVATIONS

SECTION 000107 – CERTIFICATION PAGE

ARCHITECT

I hereby certify that this plan, specification, Divisions 02 through 14, or report was prepared by me or under my direct supervision and that I am a duly licensed Architect under the laws of the State of Minnesota.

Signed by:
Les M. Rowland 1/6/2025
Les Rowland Date
License No. 7139

STRUCTURAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Structural Engineer under the laws of the State of Minnesota.

Signed by:
Blake Tideman 1/6/2025
Blake Tideman Date
License No. 11135

MECHANICAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Mechanical Engineer under the laws of the State of Minnesota.

Signed by:
Michael Doleys 1/6/2025
Michael Doleys Date
License No. 24659

ELECTRICAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Electrical Engineer under the laws of the State of Minnesota.

DocuSigned by:
Jay Hruby 1/6/2025
Jay Hruby Date
License No. 40290

CLINTON-GRACEVILLE-BEARDSLEY SCHOOLS
2025 ADDITION & RENOVATIONS

CIVIL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Civil Engineer under the laws of the State of Minnesota.

Signed by:
Patrick Carey 1/6/2025
Patrick Carey Date
License No. 48442

STRUCTURAL ENGINEER (ROOFING)

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Structural Engineer under the laws of the State of Minnesota.

Signed by:
Dillon Rudrud 1/6/2025
Dillon Rudrud Date
License No.60821

END OF SECTION 000107

SECTION 000110 – TABLE OF CONTENTS
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INTRODUCTORY INFORMATION VOLUME 1

PROCUREMENT REQUIREMENTS

CONTRACTING REQUIREMENTS

DIVISION 01 – GENERAL REQUIREMENTS

END OF SECTION 000110

SECTION 001116 – INVITATION TO BID

PART 1 - GENERAL

1.1 PROJECT INFORMATION

A. Notice to Bidders: Qualified Bidders are invited to submit Bids for Project as described in this Document per Instructions to Bidders.

B. Project Identification: Clinton-Graceville-Beardsley Schools
2025 Addition & Renovations
712 East 3rd Street
Gracville, MN 56240

C. Owner: Clinton-Graceville-Beardsley District 2888
601 1st Street
Clinton, MN 56225

1. Owners Representative: Brad Kelvington

D. Program Construction Manager: SitelogIQ, Inc.
7900 West 78th Street, Suite 400
Edina, MN 55439

E. Architect: DesignArc Group
434 5th Street, Suite 1
Brookings, SD 57006

F. Construction Contract: Bids will be received for the following Work associated with completion of 2025 Addition & Renovations:

1. Multiple Contract Project consisting of the following prime contracts:
   a. General Trades Construction
   b. Mechanical Construction
   c. Electrical Construction
   d. Temperature Controls Construction
   e. TAB Construction
   f. Roofing Construction

1.2 BID SUBMITTAL AND OPENING

A. Owner will receive sealed envelopes, containing Bids marked "Clinton-Graceville-Beardsley Schools 2025 Addition & Renovations Bid" and address of Bidder until Bid time and date at location indicated below. Owner will consider Bids prepared in compliance with Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: January 29, 2025
2. Bid Time: 2:00 PM, local time
3. Location: Clinton-Graceville-Beardsley District 2888
   601 1st Street
   Clinton, MN 56225
   Attn: Brad Kelvington

B. Bids will be thereafter publicly opened and read aloud.

C. Submit Bids that reflect costs necessary to meet construction schedule requirement as indicated in Time of Completion Article below.

D. Submit Bids that are typewritten or written legibly in ink on forms provided herein and fill out applicable spaces on the forms. Unsigned Bids will not be considered.

1.3 BID SECURITY

A. Submit Bid security, in form of certified check, cashier's check, or acceptable Bidder's Bond, made payable to Owner, with each Bid in amount of Five Percent (5%) of Bid amount. No Bids may be withdrawn for a period of sixty (60) days after opening of Bids. Owner reserves the right to reject any and all Bids and to waive informalities and irregularities.
   1. Bid security is a guarantee that Bidder will, if awarded, enter into Contract per Contract Documents and submitted Bid.

1.4 PRE-BID MEETING

A. Program Construction Manager/Design Team will conduct a Pre-bid meeting as indicated below:
   1. Meeting Date: January 14, 2025
   2. Meeting Time: 1:00 PM, local time
   3. Location: Clinton-Graceville-Beardsley Schools, 712 East 3rd Street, Gracville, MN 56240

B. Attendance: Bidders' attendance is recommended in order to better understand Project, and for dissemination of information and clarification of intent of Bidding Documents

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

1.5 DOCUMENTS

A. Printed Procurement and Contracting Documents: Plans should be available on or about January 06, 2026 by contacting Barbara Comstock at 952-223-4411 for instructions to access the online plan room. Documents will be issued only as complete sets to qualified bidding contractors are responsible to review all documents and must download complete sets.

B. Contracts for Work under this Bid will obligate Contractors and Subcontractors to maintain policies of employment under provisions of applicable Federal and State laws against discrimination, including the Civil Rights Act of 1964 and Minnesota Statutes section 363.

1.6 TIME OF COMPLETION

A. Bidders shall begin Work on receipt of Notice to Proceed and shall complete Work within Contract Time.

1.7 BIDDER'S QUALIFICATIONS

A. Bidders shall be properly licensed under laws governing their respective trades and be able to obtain insurance and bonds required for Work. Successful Bidder will be required to submit Performance Bond, and separate Labor and Material Payment Bond in amount of 100 percent of Contract Sum, and Insurance in a form acceptable to Owner.

1.8 METHOD OF CONTRACTING AND PROPOSED SCHEDULE

A. Work will be constructed under a Program Construction Manager – Advisor contract, as described by Contract Documents.

1.9 SITE REVIEW

A. Prior to submitting Bid for Work, Contractors are required and expected to have examined Project site and premises and be thoroughly familiarized with existing conditions under which Contractors will be obligated to operate or which will in any way affect Work under this Contract.

B. Bidders and Sub-Bidders are further cautioned to become familiar with contents, alternates, revisions, addenda, General Conditions, Special Conditions, Specifications, Drawings, and Work of other Contractors. Should Bidder find discrepancies or omissions in Bidding Documents, or should there be doubt as to intent, notify Program Construction Manager at once, who may, if necessary, issue written instructions to Bidders.

C. Notify Program Construction Manager of apparent variances in Bidding Documents from conditions as they exist at Project site. Failure to comply with above requirements does not relieve Contractors of requirements of Contract Documents.

D. No extras will be allowed because of Bidder's misunderstanding as to amount of Work involved, Contractor's own error or negligence, or failure to examine Project site. Lack of knowledge of conditions pertaining to Work shall not relieve Contractor from performing Work required to complete performance of Contract.

END OF SECTION 001116

SECTION 002113 – INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. AIA Document A701 – 2018, Instructions to Bidders, is incorporated into these Specifications.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 002113

AIA® Document A701™ - 2018

Instructions to Bidders

for the following PROJECT:
Clinton-Graceville Beardsley Schools
2025 Addition & Renovations
712 East 3rd Street
Graceville, MN 56240

OWNER:
Clinton-Graceville Beardsley District 2888
601 1st Street
Clinton, MN 56225

PROGRAM CONSTRUCTION MANAGER

SitelogIQ, Inc.
7900 W 78th St, Suite 400
Edina, MN 55439

ARCHITECT

DesignArc Group
434 5th Street, Suite 1
Brookings, SD 57006

TABLE OF ARTICLES

ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

§ 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 (10) days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

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

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

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

§ 3.2 MODIFICATION OR INTERPRETATION OF BIDDING DOCUMENTS

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

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven (7) days prior to the date for receipt of Bids.

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

§ 3.3 SUBSTITUTIONS

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

§ 3.3.2 Substitution Process

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

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

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

contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

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

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

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

§ 3.4 ADDENDA

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

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further

name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

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

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders.

§ 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.

§ 4.3 SUBMISSION OF BIDS

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

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

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

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

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

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

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

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

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

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

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

§ 5.3 ACCEPTANCE OF BID (AWARD)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

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

§ 6.2 OWNER'S FINANCIAL CAPABILITY

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

§ 6.3 SUBMITTALS

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

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

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

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

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

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

.1 The Contract between Owner and Contractor.

.2 All Specifications, including Section 007200 "General Conditions of the Contract for Construction" (AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition).

.3 All Drawings

.4 All Addenda issued prior to the bid date.

.5 All Exhibits issued prior to the bid date.

END OF SECTION 002213

SECTION 002413 – SCOPES OF BID

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 & 01 Specification Sections, apply to this section.

B. Section 011100 “Summary of Work.”

1.2 DIVISION OF CONTRACT

A. This Project is being performed with a Program Construction Manager acting as an Adviser. Owner, through Program Construction Manager, will award separate Contracts for Work described in this Document. Project will be administered, managed, and coordinated by the Program Construction Manager.

B. Although each Contract involves an apparent segment of “conventional” subcontracting, multiple Contract performance requires that adjustments be made to permit completion of a Contract as a construction unit. Each Contractor shall review total scope of their responsibilities with respect to their Work and provide for same in Bid submittal.

C. Work relative to Project is identified by Contract Documents. Each Contractor is required to review entire set of Contract Documents to completely determine Contractor’s Scope of Work, and to become familiar with scope of Work of others. Nothing contained in Work scope descriptions shall be constructed as overriding or changing Contract Documents. Disputes concerning assignment of Work between prime Contracts will be interpreted by the Program Construction Manager, and recommendations for resolution of dispute provided to the Owner.

D. The scope of each Contractor’s Work is defined in this Document. Each Contractor shall familiarize themselves with requirements of those Contracts that interface with their own. Contractor shall consider the fact that their Work follows Work of another Contractor and that still another Contractor will interface with Work of their own.

E. Nothing contained in Contract Documents, and especially in Work Scope, shall be construed as a Work assignment to construction industry trade. Each Contractor is responsible for their own decision, means, and methods on Work assignments and shall make them per prevailing practice in the locality of the Project, and in such a way that neither Contractor’s progress, nor progress of others, shall be adversely affected by Contractor’s decision.

F. There is no limit to number of Contracts or combination of Contracts any one Contractor may Bid. Owner reserves the right to award individual contracts or any combination of contracts per Bids received.

1.3 SAFETY - LEAD CONTRACTOR DESIGNATION

A. The **General Trades Contractor** shall be designated as the “Lead Safety Contractor” and “Competent Person” with respect to jobsite safety. Responsibilities and authority of the Contractor shall be as designated in Section 013500 “Safety.” The “Lead Safety Contractor” will serve to identify areas of concern and will endeavor to accomplish required corrections through cooperation of other Prime Contractors.

1.4 WORK PACKAGE NO. 1 - GENERAL TRADES

A. The Scope of Work for Work Package No. 1 - General Trades Improvements includes the following: Construction Drawings, Specification Divisions 00, 01 and 02, and Specifications Sections as referenced below.

B. **The General Trades Contractor** will be the lead contractor responsible for providing the project schedule and majority of work required by contract drawings and associated specifications. This contractor shall perform, generally, all General Trades work (Site Construction, Concrete, Masonry, Metals, Woods/Plastics, Thermal and Moisture Protection, Openings, Finishes, Specialties, Equipment, Furnishings, Earthwork, Exterior Improvements, and Site Utilities) as designated on drawings including but not limited the items listed below.

1. The awardee of this Work Package shall be considered a Prime Contractor.
2. The General Trades Contractor shall be responsible for providing the Building Permit which includes the full project value of all trades along with any other permits fees liscenses and inpections by government agenceies necessary for proper execution and completion of the Work of this bid package.
3. General Trades Contractor shall be responsible for providing labor, material, and equipment to complete work associated Divisions 00 through 14, and Divisions 31 through 33, including Sections referenced but not included therein, and excluding the work included in Work Package No. 6 - Roofing.
4. The General Trades Contractor will provide and install site fencing for the entire project. This will include the lay down area for all trades, saftey and security areas and OSHA required work fencing per Section 011000 "Summary of Work." Install all fencing including construction fencing per drawings. This is to include maintenance of the construction fence throughout the project. See Section 011000 “Summary of Work” for fencing layout
5. The General Trades Prime Contractor shall be the sole provider of refuse dumpsters for construction, and demolition work associated with this project for all trades. Comply with Section 015000 “Temporary Facilities and Controls.”
6. The General Trade Prime Contractor shall provide Sanitary Facilities for all trades including portable toilets and portable hand wash stations. Comply with Section 015000 “Temporary Facilities and Controls.”
7. The General Trades Prime Contractor shall provide labor for daily site cleanup for safe housekeeping means. Comply with Section 017300 “Execution.”
8. The General Trades Prime Contractor shall provide and install floor protection for existing corridors and rooms, minimum ¼” masonite with taped seams.
9. Include timely submission of insurance certificates, shop drawing submittals, schedule of values, product data, etc.
10. Provide any required disposal manifests.
11. Provide and allow for protection of structure, site, and materials to remain.
12. Include sufficient manpower to comply with the construction schedule. Bids must include all necessary overtime you will need to complete this project within the allotted time.
13. Provide all necessary equipment such as cranes, scaffold, hoists, lifts, etc, as required for a complete installation.
14. Establish and comply with a project safety program, and OSHA guidelines.
15. Provide regular site cleanup as directed by the construction manager.
16. Coordinate Demolition and Construction activities with other trades
17. Temporary roads, enclosures, standing water control and other temporary facility and control items as outlined here and within specification Section 015000 “Temporary Facilities and Controls.”
    a. Re-grade construction site and staging areas after every rain event as needed and no later than 8 hours after any rain event over ¼ inch Erosion control and all associated maintenance, repair, removal and restoration of grounds to be included.

b. Provide snow removal at construction site and staging areas after every snow event as needed and no later than 8 hours after any snow event over ½ inch.
c. Provide temporary dewatering facilities and drains as required. Dewatering devices such as tarping, trenches, pumps, etc to be maintained 7 days a week 24 hours a day to promote a dry construction site.
d. Coordinate all disruptions with the program manager. Trench no more than 10 feet at a time so as to keep access to construction entrance for trucks, workers and deliveries at all times. Provide access ramps or temporary grading as needed to keep access for all construction activities at all times. Cutting off access for more than 15 minutes during regular work hours will not be permitted without prior approval and coordination with construction program manager.

18. The General Trade Contractor shall provide temporary construction heating and ventilation as required for construction activities. The contractor is responsible for providing and monitoring all temporary equipment. The contractor will be responsible for providing all connections and monitoring of the propane tank(s). The owner will be responsible for paying for propane. Comply with Section 015000 "Temporary Facilities and Controls."
19. Provide penetration firestopping at fire-rated walls, ceilings, and floors.
20. Provide joint firestopping.
21. Provide final cleaning per Section 017700 "Closeout Procedures."
22. Include timely submission of insurance certificates, shop drawing submittals, schedule of values, product data, etc.
23. Include Cost of Performance Bond and Labor and Material Payment Bond in Bid as indicated in Section 004113 "Bid Form."
24. The General Trades Contractor will maintain primary responsibility for the safety of their workers and its subcontractor(s).
25. The General Trades contractor will be responsible for maintaining an on-site record of Safety orientation, and visible identification that orientation has been completed (i.e. hard hat stickers).
26. The General Trades contractor is responsible for all the roof fall protection for all work packages except the roofing prime contractor package.

1.5 WORK PACKAGE NO. 2 - MECHANICAL

A. The Scope of Work for Work Package No. 2 - Mechanical Improvements includes the following: Construction Drawings, Specification Divisions 00, 01 and 02, and Specifications Sections as referenced below.

B. **The Mechanical Contractor** will be responsible for all mechanical work (demolition, equipment, sheet metal, fire protection, plumbing, and hydronic piping) as designated on drawings including but not limited the items listed below.
1. The awardee of this Work Package shall be considered a Prime Contractor.
2. The Mechanical Contractor shall be responsible for providing any permits fees liscenses and inpections by government agencies necessary for proper execution and completion of the Work of this bid package.
3. Mechanical Contractor shall be responsible for providing labor, material, and equipment to complete work associated with Divisions 00, 01, 02, 21, 22, and 23, including Sections referenced but not included therein, but excluding Section 230593 "Testing, Adjusting, and Balancing for HVAC," Section 230923 "Digital Direct Control System for HVAC," Section 230933 "Variable Frequency Motor Controllers," and Section 230993 "Sequence of Operations for HVAC Controls."
4. Include timely submission of insurance certificates, shop drawing submittals, schedule of values, product data, etc.
5. Provide and allow for protection of structure, equipment, and materials to remain. Provide floor, roof, grounds or any site protection in addition to that specified "By General Trades" if needed to

accommodate moving or storing of specific equipment (including cranes and lifts etc) needing additional protection.

6. Include control valve and motorized damper installation.
7. Include sufficient manpower to comply with the construction schedule. Bids must include all necessary overtime you will need to complete this project within the allotted time.
8. Provide all necessary equipment such as cranes, scaffold, hoists, lifts, etc., as required for a complete installation.
9. Provide all required cutting and patching for mechanical penetrations, and sealing penetrations of removed ductwork, and/or piping.
10. Coordinate roofing penetrations, and roof mounted equipment, stands, supports, etc., with the Roofing Contractor.
11. Establish and comply with a project safety program, and OSHA guidelines.
12. Provide regular site cleanup as directed by the Program Construction Manager.
13. Provide penetration firestopping at fire-rated walls, ceilings, and floors.
14. Include Cost of Performance Bond and Labor and Material Payment Bond in Bid as indicated in Section 004113 "Bid Form."
15. The Mechanical Contractor will maintain primary responsibility for the safety of their workers and its subcontractor(s).

1.6 WORK PACKAGE NO. 3 - ELECTRICAL

A. The Scope of Work for Work Package No. 3 - Electrical Improvements includes the following: Construction Drawings, Specification Divisions 00, 01 and 02, and Specifications Sections as referenced below.

B. **The Electrical Contractor** will be responsible for all associated electrical and communications work required by the contract drawings, and associated specifications including but not limited the items listed below.

1. The awardee of this Work Package shall be considered a Prime Contractor.
2. The Electrical Contractor shall be responsible for providing any permits fees liscenses and inpections by government agencies necessary for proper execution and completion of the Work of this bid package.
3. Electrical Contractor shall be responsible for providing labor, material, and equipment to complete work associated with the following Divisions 00 through 02, Divisions 26 through 28 including Sections referenced but not included therein.
4. Include timely submission of insurance certificates, shop drawing submittals, schedule of values, product data, etc.
5. Provide any required disposal manifests.
6. Provide and allow for protection of structure, equipment, and materials to remain. Provide floor, roof, grounds or any site protection in addition to that specified "By General Trades" if needed to accommodate moving or storing of specific equipment (including cranes and lifts etc.) needing additional protection.
7. Include sufficient manpower to comply with the construction schedule. Bids must include all necessary overtime you will need to complete this project within the allotted time.
8. Include wiring to the Construction Trailer. Comply with Section 015000 "Temporary Facilities and Controls."
9. Provide all necessary equipment such as cranes, scaffold, hoists, lifts, etc., as required for a complete installation.
10. Provide all required cutting and patching for electrical penetrations, and sealing penetrations of removed conduit, and/or wiring.
11. Coordinate roofing penetrations, and roof mounted equipment, stands, supports, etc., with the Roofing Contractor.

12. Establish and comply with a project safety program, and OSHA guidelines.
13. Provide regular site cleanup as directed by construction manager. Comply with Section 017300 "Execution."
14. Provide penetration firestopping at fire-rated walls, ceilings, and floors.
15. Include Cost of Performance Bond and Labor and Material Payment Bond in Bid as indicated in Section 004113 "Bid Form."
16. The Electrical Contractor will maintain primary responsibility for the safety of their workers and its subcontractor(s).
17. The following equipment has been pre-purchased by owner;
    a. Electrical Equipment
        1) Main Distribution Panel (MSB2) identified in drawings sheet E5.4 (Details Electrical (Owner Furnished, Contractor Installed)).
    b. The Electrical Contractor shall be responsible for shipment coordination, receipt, tarping, protecting, staging, installation, scheduling of startup, and installation labor warranty of pre-purchased equipment. Electrical contractor shall also be responsible for disposal and removal of all associated packing materials.

1.7 WORK PACKAGE NO. 4 - TEMPERATURE CONTROLS

A. The Scope of Work for Work Package No. 4 - Temperature Controls Improvements includes the following: Construction Drawings, Specification Divisions 00, 01 and 02, and Specifications Sections as referenced below.

B. **The Temperature Controls Contractor** will be responsible for all temperature controls work required by Demolition, HVAC, Piping, & Electrical drawings, Temperature controls specifications, and other associated specifications including but not limited the Sections listed below.
1. The awardee of this Work Package shall be considered a Prime Contractor.
2. The Temperature Controls Contractor shall be responsible for providing any permits fees liscenses and inpections by government agencies necessary for proper execution and completion of the Work of this bid package.
3. Temperature Control Contractor shall be responsible for providing labor, material, and equipment to complete work associated with Divisions 00, 01, 02, Section 230923 "Digital Direct Control System for HVAC," Section 230933 "Variable Frequency Motor Controllers," and Section 230993 "Sequence of Operations for HVAC Controls" including any Sections referenced but not included therein.
4. Include timely submission of insurance certificates, shop drawing submittals, schedule of values, product data, etc.
5. Provide and allow for protection of structure, equipment, and materials to remain. Provide floor, roof, grounds or any site protection in addition to that specified "By General Trades" if needed to accommodate moving or storing of specific equipment (including cranes and lifts etc) needing additional protection.
6. Include sufficient manpower to comply with the construction schedule. Bids must include all necessary overtime you will need to complete this project within the allotted time.
7. Provide all necessary equipment such as cranes, scaffold, hoists, lifts, etc., as required for a complete installation.
8. Provide all required cutting and patching for control penetrations, and sealing penetrations of removed control conduit, tubing and/or wiring.
9. Coordinate roofing penetrations, and roof mounted equipment, stands, supports, etc. with the General Trades Contractor.
10. Establish and comply with a project safety program, and OSHA guidelines.
11. Provide regular site cleanup as directed by construction manager. Comply with Section 017300 "Execution."

12. Provide penetration firestopping at fire-rated walls, ceilings, and floors.
13. Include Cost of Performance Bond and Labor and Material Payment Bond in Bid as indicated in Section 004113 "Bid Form."
14. The Temperature Control Contractor will maintain primary responsibility for the safety of their workers and its subcontractor(s).

1.8 WORK PACKAGE NO. 5 – TESTING ADJUSTING AND BALANCING (BID SEPARATELY)

A. The Scope of Work for Work Package No. 5 – Testing Adjusting and Balancing Improvements includes the following: Construction Drawings, Specification Divisions 00, 01 and 02, and Specifications Sections as referenced below.

B. **The Testing Adjusting and Balancing Contractor** will be responsible for all testing, adjusting & balancing work required by the HVAC, & Piping drawings, and associated specification including but not limited to the Sections listed below

1. The The awardee of this Work Package shall be considered a Prime Contractor.
2. Testing Adjusting and Balancing Contractor shall be responsible for providing labor, material, and equipment to complete work associated with Divisions 00 through 02, and Specification Section 230593 "Testing Adjusting and Balancing for HVAC" including any Sections referenced but not included therein.
3. Establish and comply with a project safety program, and OSHA guidelines.
4. Provide final cleaning per Section 017700 "Closeout Procedures."
5. The Testing Adjusting and Balancing Contractor will maintain primary responsibility for the safety of their workers and its subcontractor(s).

1.9 WORK PACKAGE NO. 6 – ROOFING

A. The Scope of Work for Work Package 6 – Roof Replacement includes the following: Construction Drawings, Specification Divisions 00, 01 and 02, and Specifications Sections as referenced:

B. **The Roofing Contractor** will be responsible for all roofing work as designated on drawings including but not limited the items listed below.

1. The awardee of this Work Package shall be considered a Prime Contractor.
2. Roofing Contractor shall be responsible for providing labor, material, and equipment to complete the roofing work associated with but not limited to Divisions 00 through 02, and Divisions 07, including Sections referenced but not included therein.
3. Provide Work as indicated in the Specification Sections and in Construction Drawings as required for this Work Package.
4. Include timely submission of insurance certificates, shop drawing submittals, schedule of values, product data, etc.
5. Provide any required disposal manifests.
6. Provide and allow for protection of structure, equipment, and materials to remain. Provide floor, roof, grounds or any site protection in addition to that specified "By General Trades" if needed to accommodate moving or storing of specific equipment (including cranes and lifts etc.) needing additional protection.
7. Include sufficient manpower to comply with the construction schedule. Bids must include all necessary overtime you will need to complete this project within the allotted time.
8. Provide all necessary equipment such as cranes, scaffold, hoists, lifts, etc. as required for a complete installation.
9. Provide all required cutting and patching for electrical penetrations, and sealing penetrations of removed conduit, and/or wiring.
10. Coordinate roofing penetrations, and roof mounted equipment, stands, supports, etc with the General Trades Contractor, Mechanical Contractor and Electrical Contractor.

11. Establish and comply with a project safety program, and OSHA guidelines.
12. Provide regular site cleanup as directed by construction manager.
13. Provide penetration firestopping at fire-rated walls, ceilings, and floors per Section 078413 "Penetration Firestopping."
14. Include Cost of Performance Bond and Labor and Material Payment Bond in Bid as indicated in Document 004113 "Bid Form."
15. The Roofing Contractor will maintain primary responsibility for the safety of their workers and its subcontractor(s).
16. The Roofing Contractor will be responsible for all the safety requirements for their work package in conjunction with the General Contractors requirements.
17. Roof fall protection for this package is the sole responsibility of the roofing contractor.
18. The contractor shall participate in a schedule development planning meeting with all trades.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 002413

CLINTON-GRACEVILLE-BEARDSLEY SCHOOLS
2025 ADDITION & RENOVATIONS
SECTION 004113 – BID FORM

1.1 BID INFORMATION

A. Bidder: _____
(Name of firm or company submitting Bid)

_____
(Address of firm or company submitting Bid)

_____
(City, State, Zip Code)

_____
(Contact Person, Telephone Number, Fax Number)

B. Project Name: Clinton-Graceville-Beardsley Schools, 2025 Addition & Renovations.

C. Project Location: 712 East 3rd Street, Gracville, MN 56240.

D. Owner: Clinton-Graceville-Beardsley District 2888, 601 1st Street, Clinton, MN 56225.
1. Owner Contact: Brad Kelvington

E. Program Construction Manager: SitelogIQ, Inc.
7900 West 78th Street, Suite 400
Edina, MN 55439

F. Architect: DesignArc Group
434 5th Street, Suite 1
Brookings, SD 57006

1.2 ACKNOWLEDGEMENT OF ADDENDA

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

1. Addendum No. 1, Dated _____
2. Addendum No. 2, Dated _____
3. Addendum No. 3, Dated_____
4. Addendum No. 4, Dated_____

1.3 CERTIFICATIONS AND BASE BID

A. Base Bid, Single Lump Sum for complete Work required by Drawings, Specifications, addenda and other issued Documents: **General Trades Work Package #1** OR **Mechanical Work Package #2** OR **Electrical Work Package #3** OR **Temperature Controls Work Package #4** OR **TAB Work Package #5** OR **Roofing Work Package #6**. Refer to Section 011100 "Summary of Work" for Project Description and Section 002413 "Scopes for Bids".
1. **Please write in which trade grouping/work package you are bidding.**
2. The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Program Construction Manager and consultants, having visited the site, and being familiar with all conditions and requirements of the Work and local sources of supply regarding quantities and conditions of Bid, hereby agrees to furnish all material, labor, equipment and services, including services, including scheduled allowances (if specified elsewhere), necessary to complete construction of above-named Project, per requirements of Procurement and Contracting Documents, for the stipulated sum of:

B. TRADE GROUP:_____

Base bid of:_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

1. Above amount may be modified by amounts indicated by Bidder in the following "Unit Prices" and "Alternates" Articles.
2. Base Bid Breakout – In order to have the above total bid considered, the included bid amount for each Specification Division included in Trade Group Scope of Work shall be listed below. Bids will be evaluated on total bid amount and not on individual Specification Division values.

Division	Included Bid Amount:
00/01 – General Conditions	
02 – Existing Conditions	
03 – Concrete	
04 – Masonry	
05 – Metals	
06 – Carpentry	
07 – Thermal and Moisture Protection	
08 - Doors, Windows, and Glass	
09 – Finishes	
10 – Specialties	
11 – Equipment	
12 – Furnishings	
21 – Fire Suppression	
22 – Plumbing	
23 – HVAC	
26 – Electrical	
27 – Communication	
31 - Earthwork	
32 – Exterior Improvements	
33 – Utilities	

C. Responsible Contractor Compliance:
1. By signing this bid form, I verify under oath that I am an owner or officer of the firm, and that as a prime contractor I am in compliance with the Responsible Contractor criteria as defined in Minnesota Statute section 16C.285, subdivision 3.

D. Bidder, in submitting this Bid, understands that Owner reserves the right to reject any or all Bids, to waive any informality or irregularity in any Bid received, and to accept any Alternate(s) in any order of combination, and that Bidder waives all rights to plead any misunderstanding regarding same.

1.4 ALTERNATES

A. Undersigned Bidder proposes amount below be added to or deducted from Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

B. If alternate does not affect Contract Sum, Bidder shall indicate "NO CHANGE."

C. If alternate does not affect Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

D. Bidder shall be responsible for determining from Contract Documents effects of each alternate on Contract Time and Contract Sum.

E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within sixty (60) days of Notice of Award unless otherwise indicated in Contract Documents.

F. Acceptance or non-acceptance of any alternates by Owner shall have no effect on Contract Time unless indicated below.

G. Refer to Section 012300 “Alternates” for complete description of Alternates. If a table is shown below the Alternate, include bid amount and applicable price on a per Specification Division Basis.

1. Alternate No. 1. North Parking Lot Asphalt. The alternate is a deduction for removing the North asphalt from scope and graded gravel parking lot to remain.
(Circle one - Add / Deduct / NoChange / NA)

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

2. Alternate No. 2. East Safe Routes Sidewalk (Circle one - Add / Deduct / NoChange / NA)

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

3. Alternate No. 3. West Safe Routes Sidewalk (Circle one - Add / Deduct / NoChange / NA)

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

4. Alternate No. 4. The base bid is a 30-year warranted design (60 mil fleece-back KEE). The alternate is a deduction for a 20-year warranted design (45 mil fleece-back KEE)
(Circle one - Add / Deduct / NoChange / NA)

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

5. Alternate No. 5. The base bid has a 1/4" dens deck prime coverboard set in low-rise foam adhesive on all roof areas. The alternate is a deduction to remove the cover board from Roof A1, C1, C2, C4 & C5. (Circle one - Add / Deduct / NoChange / NA)

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

6. Alternate No. 6. At FACS area 209, provide alternate cost for "commercial learning equipment." See elevations on page A3.2. (Circle one - Add / Deduct / NoChange / NA)

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

1.5 BID GUARANTEE

A. Undersigned Bidder agrees to execute a Contract for this Work in above amount and to furnish surety as specified within ten (10) days after a written Notice of Award, if offered within sixty (60) days after receipt of Bids, and on failure to do so, agrees to forfeit to Owner the attached cash, cashier's check, certified check, US money order, or Bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of Base Bid amount above:

_____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

C. Site Visit: Bidder hereby acknowledges that Bidder has visited Work site to verify existing conditions regarding Bidding and Contract Documents.

1. Date of Site Visit: _____.

D. Taxes, levied by Federal, State, or municipal government, which Undersigned stipulates are applicable to this Work, are included in Base Bid Sum unless indicated otherwise.

1.6 TIME OF COMPLETION

A. Undersigned Bidder proposes and agrees hereby to commence Work of Contract Documents on date specified in written Notice to Proceed to be issued by Program Construction Manager, and provide all equipment, installation, start-up within the time expectation as stated in the construction documents. _____ (initial).

B. Notice to Proceed will be given on or about February 25, 2025.

C. Owner requires Work to be Substantially Complete and reoccupied as follows:

Phase	Substantial Completion Date
Phase 1 Gym, Locker Rooms, Multipurpose and Wellness Addition	February 20, 2026
Phase 1* Pre-k Addition	July 22, 2026
Phase 2	December 26, 2025
Phase 3	August 22, 2025
Phase 4 and Phase 5	August 21, 2026

1.7 PERFORMANCE AND PAYMENT BONDS

A. Cost of Performance Bond and Labor and Material Payment Bond shall be included in Base Bid.

B. If Owner accepts this Bid within time period stated, Bidder will furnish required bonds and insurance coverages and execute Contract within ten (10) calendar days of receipt of Notice of Award.

C. Submit cashier's check, certified check, or Bid Bond, payable to Owner as Bid Security, with each Bid.

D. If Bid is accepted within time stated, and Bidder fails to commence Work, or Bidder fails to provide required Bond(s), Bidder forfeits Bid Security to Owner by reason of Bidder's failure, limited in amount to lesser of face value of Bid Security or difference between this Bid and Bid upon which Contract is signed.

E. In event Bid is not accepted within time stated, required Bid Security will be returned to undersigned per provisions of Supplementary Instructions.

1.8 UNIT PRICES

A. Undersigned Bidder proposes amounts below be added to or deducted from Contract Sum on performance and measurement of individual items of Work and for adjustment of quantity given in Unit-Price Allowance for actual measurement of individual items of Work.

B. If unit price does not affect Work of this Contract, Bidder shall indicate "NOT APPLICABLE."

C. Refer to Section 012200 "Unit Prices" for complete description of Unit Prices.

1. Unit Price No. 1. Fill Dirt

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

2. Unit Price No. 2. Sidewalk

_____ Dollars ($_____)
(State the bids in text and in numerals on the lines above)

1.9 CONTRACTOR'S LICENSE

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

1.10 SUBMISSION OF BID

Respectfully submitted this ____ day of _____, 20___.

Submitted By: _____
(Name of Bidding firm or corporation)

Authorized Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

Witness By: _____
(Handwritten signature)

Attest: _____
(Handwritten signature)

By: _____
(Type or print name)

Title: _____
(Corporate Secretary or Assistant Secretary)

Street Address: _____

City, State, Zip _____

Phone: _____

License No.: _____

Federal ID No.: _____

NON-COLLUSION AFFIDAVIT

State of: _____

County of _____

_____, being the first duly sworn, deposes and says that:

(1) He/she is _____ of _____,
(Title) (Company)

the Bidder that has submitted attached Bid;

(2) He/she is fully informed respecting preparation and contents of attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid;

(4) Attached Bid has been arrived at by the Bidder independently, and has been submitted without collusion with, and without any agreement, understanding, or planned common course of action with, any other vendor of materials, supplies, equipment, or services described in Invitation to Bid, designed to limit independent Bidding or competition;

(5) That neither said Bidder nor any of its officers, partners, owners, agents, representatives, employees, or parties in interest, including this affiant, has in any way colluded, conspired, connived, or agreed directly or indirectly with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with contract for which attached Bid has been submitted, or to refrain from Bidding in connection with such contract, or has in any manner directly or indirectly sought by agreement, collusion, communication, or conference with any other Bidder, firm, or person to fix Amount or Amounts in attached Bid or of any other Bidder, or to fix any overhead, profit, or cost element of Bid Amount or the Bid Amount of any other Bidder, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against any entity or person interested in proposed contract;

(6) That contents of Bid or Bids have not been communicated by Bidder or its employees or agents to any person not an employee or agent of Bidder or its surety on any bond furnished with Bid or Bids, and will not be communicated to any such person prior to official opening of Bid or Bids; and

(7) That Amount or Amounts quoted in attached Bid are fair, proper, and not tainted by any collusion, conspiracy, connivance, or unlawful agreement on part of Bidder or any of its agent's representatives, owners, employees, or parties in interest, including this affiant.

Signature: _____

Title: _____

Date: _____

Subscribed and sworn to before me

this: _____ day of 20____

Notary Public Signature: _____

My commission expires _____

END OF SECTION 004113

CLINTON-GRACEVILLE BEARDSLEY SCHOOLS
2025 ADDITION & RENOVATIONS

SECTION 004114 – CONTRACTOR PREQUALIFICATION

PART 1 - GENERAL

1.1 PROJECT INFORMATION

A. Notice to Bidders: The following list of questions will assist the Owner and SitelogIQ, Inc. in pre-qualifying the bidding contractors. Return your response to these questions (as they apply to your bidding package/s) in writing to SitelogIQ, Inc.; Attention Darin Klein, darin.klein@sitelogiq.com at least twenty-four (24) hours prior to your bid. Your response shall be a signed response on your company letterhead.

1.2 CONTRACTOR INFORMATION

A. Type of Work: Indicate the type of work your company performs

- ☐ General Construction
- ☐ Mechanical
- ☐ Plumbing
- ☐ Electrical
- ☐ Temperature Controls
- ☐ Ceilings
- ☐ Other _____

B. Principal Office:

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

C. Organization:

1. How many years has your organization been in business as a Contractor? _____
2. How many years has your organization been in business under its present business name? _____
3. Under what other or former names has your organization operated? _____

_____

D. Experience:

1. List the categories of Work that your organization normally performs with its own forces?

_____

_____

E. Claims and Suits: (If the answer to any of the below questions is "yes", please attach details).

1. Has your organization ever failed to complete any work awarded to it? _____
2. Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? _____
3. Has your organization filed any lawsuits or requested arbitration with regards to construction contracts within the last five years? _____
4. Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is "yes", please attach details.) _____

F. Work in Progress and References

1. On a separate piece of paper, list major construction projects your organization has in progress, giving the name of the project, percent of complete, and scheduled completion dates.
2. On a separate piece of paper, list the major projects your organization has completed in the past five years, giving the name of the project, contract amount, date of completion and percentage of the cost of the work performed by your own forces, and reference contact information.

G. Specification Alignment:

1. Was a formal site inspection performed by your company confirming the existing conditions and re-routing of existing work? Y / N

H. Product Alignment:

1. Is all material included in the bid as specified or prior approved? Y / N

I. Plan of attack:

1. Do you plan to have a project foreman on site daily from your company? Y / N
2. Does your bid include representation / attendance at all construction meetings? Y / N
3. Does your bid include coordination as required with other construction trades? Y / N
4. Does your bid represent the proper manpower loading to meet the dates as outlined in specification section 011100 "Summary of Work?" Y / N
5. Do you acknowledge that failure to meet these deadlines may result in your work having to be completed during non-school hours? Y / N

J. Signature of Response:

_____

_____(Printed)

K. Company Name

_____

_____(Printed)

END OF SECTION 004114

SECTION 004115 – MINNESOTA RESPONSIBLE CONTRACTOR COMPLIANCE AFFIDAVIT

The undersigned, the Owner or Officer of_____(Prime or Subcontractor Name) (hereinafter, the "Certifying Contractor")verify under oath that as a contractor I am in compliance with the following minimum criteria per Minnesota Statute 16C.285 Subd. 3:

1. The contractor:

   i. Is in compliance with workers' compensation and unemployment insurance requirements;
   ii. Is currently registered with the Department of Revenue and the Department of Employment and Economic Development if it has employees;
   iii. Has a valid federal tax identification number or a valid Social Security number if an individual; and
   iv. Has filed a certificate of authority to transact business in Minnesota with the secretary of state if a foreign corporation or cooperative;

2. The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 177.24, 177.25, 177.41 to 177.44, 181.13, 181.14, or 181.722, and has not violated United States Code, title 29, sections 201 to 219, or United States Code, title 40, sections 3141 to 3148. For purposes of this clause, a violation occurs when a contractor or related entity:

   i. Repeatedly fails to pay statutorily required wages or penalties on one or more separate projects for a total underpayment of $25,000 or more within the three-year period;
   ii. Has been issued an order to comply by the commissioner of labor and industry that has become final;
   iii. Has been issued at least two determination letters within the three-year period by the Department of Transportation finding an underpayment by the contractor or related entity to its own employees;
   iv. Has been found by the commissioner of labor and industry to have repeatedly or willfully violated any of the sections referenced in this clause pursuant to section 177.27;
   v. Has been issued a ruling or findings of underpayment by the administrator of the Wage and Hour Division of the United States Department of Labor that have become final or have been upheld by an administrative law judge or the Administrative Review Board; or
   vi. Has been found liable for underpayment of wages or penalties or misrepresenting a construction worker as an independent contractor in an action brought in a court having jurisdiction.

   Provided that, if the contractor or related entity contests a determination of underpayment by the Department of Transportation in a contested case proceeding, a violation does not occur until the contested case proceeding has concluded with a determination that the contractor or related entity underpaid wages or penalties;

3. The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated chapter 326B. For purposes of this clause, a violation occurs when a contractor or related entity has been issued a final administrative or licensing order;

4. The contractor or related entity has not, more than twice during the three-year period before submitting the verification, had a certificate of compliance under section 363A.36 revoked or suspended based on the provisions of section 363A.36, with the revocation or suspension becoming final because it was

upheld by the Office of Administrative Hearings or was not appealed to the office;

5. The contractor or related entity has not received a final determination assessing a monetary sanction from the Department of Administration or Transportation for failure to meet targeted group business, disadvantaged business enterprise, or veteran-owned business goals, due to a lack of good faith effort, more than once during the three-year period before submitting the verification;

6. The contractor or related entity is not currently suspended or debarred by the federal government or the state of Minnesota or any of its departments, commissions, agencies, or political subdivisions; and

7. All subcontractors that the contractor intends to use to perform project work have verified to the contractor through a signed statement under oath by an owner or officer that they meet the minimum criteria listed in clauses 1 to 6.

Any violations, suspensions, revocations, or sanctions, as defined in clauses (2) to (5), occurring prior to July 1, 2014, shall not be considered in determining whether a contractor or related entity meets the minimum criteria.

CONTRACTOR OR SUBCONTRACTOR

_____

By: _____

Its: _____

STATE OF _____)

COUNTY OF_____)

Sworn to and subscribed to before me this_____day of_____, 20_____.

Notary Public,_____County, State of _____

My Commission Expires: _____

END OF SECTION 004115

SECTION 004116 - RESPONSIBLE CONTRACTOR VERIFICATION

ANDCERTIFICATION OF COMPLIANCE ATTACHMENT A

PROJECT TITLE: **Clinton-Graceville Beardsley Schools**
2025 Addition & Renovations

COMPANY NAME: _____

Minn. Stat. § 16C.285, Subd. 7. **IMPLEMENTATION**. … any prime contractor or subcontractor that does not meet the minimum criteria in subdivision 3 or fails to verify that it meets those criteria is not a responsible contractor and is not eligible to be awarded a construction contract for the project or to perform work on the project.

Minn. Stat. § 16C.285, Subd. 3**. RESPONSIBLE CONTRACTOR, MINIMUM CRITERIA**. "Responsible contractor" means a contractor that conforms to the responsibility requirements in the solicitation document for its portion of the work on the project and verifies that it meets the following minimum criteria:

1. The contractor:
    a. is in compliance with workers' compensation and unemployment insurance requirements;
    b. is currently registered with the Department of Revenue and the Department of Employment and Economic Development if it has employees;
    c. has a valid federal tax identification number or a valid Social Security number if an individual; and
    d. has filed a certificate of authority to transact business in Minnesota with the Secretary of State if a foreign corporation or cooperative.
2. The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 177.24, 177.25, 177.41 to 177.44, 181.13, 181.14, or 181.722, and has not violated United States Code, title 29, sections 201 to 219, or United States Code, title 40, sections 3141 to 3148. For purposes of this clause, a violation occurs when a contractor or related entity:
    a. repeatedly fails to pay statutorily required wages or penalties on one or more separate projects for a total underpayment of $25,000 or more within the three-year period;
    b. has been issued an order to comply by the commissioner of Labor and Industry that has become final;
    c. has been issued at least two determination letters within the three-year period by the Department of Transportation finding an underpayment by the contractor or related entity to its own employees;
    d. has been found by the commissioner of Labor and Industry to have repeatedly or willfully violated any of the sections referenced in this clause pursuant to section 177.27;
    e. has been issued a ruling or findings of underpayment by the administrator of the Wage and Hour Division of the United States Department of Labor that have become final or have been upheld by an administrative law judge or the Administrative Review Board; or

f. has been found liable for underpayment of wages or penalties or misrepresenting a construction worker as an independent contractor in an action brought in a court having jurisdiction. Provided that, if the contractor or related entity contests a determination of underpayment by the Department of Transportation in a contested case proceeding, a violation does not occur until the contested case proceeding has concluded with a determination that the contractor or related entity underpaid wages or penalties;*

3. The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 181.723 or chapter 326B. For purposes of this clause, a violation occurs when a contractor or related entity has been issued a final administrative or licensing order;*

4. The contractor or related entity has not, more than twice during the three-year period before submitting the verification, had a certificate of compliance under section 363A.36 revoked or suspended based on the provisions of section 363A.36, with the revocation or suspension becoming final because it was upheld by the Office of Administrative Hearings or was not appealed to the office;*

5. The contractor or related entity has not received a final determination assessing a monetary sanction from the Department of Administration or Transportation for failure to meet targeted group business, disadvantaged business enterprise, or veteran-owned business goals, due to a lack of good faith effort, more than once during the three-year period before submitting the verification;*

6. The contractor or related entity is not currently suspended or debarred by the federal government or the state of Minnesota or any of its departments, commissions, agencies, or political subdivisions; and

7. All subcontractors that the contractor intends to use to perform project work have verified to the contractor through a signed statement under oath by an owner or officer that they meet the minimum criteria listed in clauses (1) to (6).

* Any violations, suspensions, revocations, or sanctions, as defined in clauses (2) to (5), occurring prior to July 1, 2014, shall not be considered in determining whether a contractor or related entity meets the minimum criteria.

Minn. Stat. § 16C.285, Subd. 4. **VERIFICATION OF COMPLIANCE**. A contractor responding to a solicitation document of a contracting authority shall submit to the contracting authority a signed statement under oath by an owner or officer verifying compliance with each of the minimum criteria in subdivision 3 at the time that it responds to the solicitation document. A contracting authority may accept a sworn statement as sufficient to demonstrate that a contractor is a responsible contractor and shall not be held liable for awarding a contract in reasonable reliance on that statement. Failure to verify compliance with any one of the minimum criteria or a false statement under oath in a verification of compliance shall render the prime contractor or subcontractor that makes the false statement ineligible to be awarded a construction contract on the project for which the verification was submitted. A false statement under oath verifying compliance with any of the minimum criteria may result in termination of a construction contract that has already been awarded to a prime contractor or subcontractor that submits a false statement. A contracting authority shall not be liable for declining to award a contract or terminating a contract based on a reasonable determination that the contractor failed to verify compliance with the minimum criteria or falsely stated that it meets the minimum criteria.

Minn. Stat. § 16C.285, Subd. 5. **SUBCONTRACTOR VERIFICATION**. A prime contractor or subcontractor shall include in its verification of compliance under subdivision 4 a list of all of its first-tier subcontractors that it intends to retain for work on the project. Prior to execution of a construction contract, and as a condition precedent to the execution of a construction contract, the apparent successful prime contractor shall submit to the

contracting authority a supplemental verification under oath confirming compliance with subdivision 3, clause (7). Each contractor or subcontractor shall obtain from all subcontractors with which it will have a direct contractual relationship a signed statement under oath by an owner or officer verifying that they meet all of the minimum criteria in subdivision 3 prior to execution of a construction contract with each subcontractor. If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors.[1] A prime contractor shall submit to the contracting authority upon request copies of the signed verifications of compliance from all subcontractors of any tier pursuant to subdivision 3, clause (7). A prime contractor and subcontractors shall not be responsible for the false statements of any subcontractor with which they do not have a direct contractual relationship. A prime contractor and subcontractors shall be responsible for false statements by their first-tier subcontractors with which they have a direct contractual relationship only if they accept the verification of compliance with actual knowledge that it contains a false statement.

[1] If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting Sections 004116 and 004117 verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification, see Section 004118, confirming compliance with Minnesota Statutes section 16C.285, subdivision 3, clause (7), within fourteen (14) days of retaining the additional subcontractors.

CERTIFICATION

a. By signing this document I certify that I am an owner or officer of the company, and I swear under oath that:

   i. My company meets each of the Minimum Criteria to be a responsible contractor as defined herein and is in compliance with Minnesota. Statutes section. 16C.285,

   ii. I have included Attachment A-1 with my company's solicitation response, and

   iii. If my company is awarded a contract, I will also submit Attachment A-2 as required.

Authorized Signature of Owner or Officer:	**Printed Name:**
Title:	**Date:**
Company Name:	

NOTE: Minnesota Statutes section 16C.285, Subdivision 2(c): If only one prime contractor responds to a solicitation document, a contracting authority may award a construction contract to the responding prime contractor even if the minimum criteria in subdivision 3 are not met.

END OF SECTION 004116

SECTION 004117 – FIRST TIER SUBCONTRACTORS LIST

FIRST-TIER SUBCONTRACTORS LIST
ATTCHMENT A-1

PROJECT TITLE: Clinton-Graceville Beardsley Schools - 2025 Addition & Renovations

Minnesota Statutes section 16C.285, subdivision 5. A prime contractor or subcontractor shall include in its verification of compliance under Minnesota Statutes section 16C.285, subdivision 4, a list of all of its first-tier subcontractors that it intends to retain for work on the project.

FIRST-TIER SUBCONTRACTOR NAMES **(Legal name of company as registered with the Secretary of State)**	**Name of city where company home office is located**

END OF SECTION 004117

SECTION 004118 – MINNESOTA RESPONSIBLE CONTRACTOR COMPLIANCE AFFIDAVIT

MINNESOTA RESPONSIBLE CONTRACTOR COMPLIANCE AFFIDAVIT
ATTACHMENT A-2

The undersigned, the Owner or Officer of_____(Prime or Subcontractor Name) (hereinafter, the "Certifying Contractor") verify under oath that as a contractor the Certifying Contractor complies with the minimum criteria of a responsible contractor as described in Minnesota Statute section 16C.285, Subdivision 3(7) and the below:

1. The Certifying Contractor has retained the following additional subcontractors not noted in its bid response: _____ (name all additional subcontractors).

2. All additional subcontractors, which are listed above, that the Certifying Contractor intends to use to perform project work have verified to the Certifying Contractor through a signed statement under oath by an owner or officer that they meet the minimum criteria listed in Section 004115, subdivisions 1 through 6.

Any violations, suspensions, revocations, or sanctions, as defined in Section 004115, subdivisions 2 through 5, occurring prior to July 1, 2014, shall not be considered in determining whether a Certifying Contractor or related entity meets the minimum criteria.

CERTIFYING CONTRACTOR

_____

By:_____

Its:_____

STATE OF _____(

COUNTY OF_____)

Sworn to and subscribed to before me this_____day of_____, 20_____.

Notary Public,_____County, State of _____

My Commission Expires: _____

END OF SECTION 004118

SECTION 006000 – PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
   1. AIA Document A132–2019, Standard Form of Agreement between Owner and Contractor, Program Construction Manager as Adviser Edition.
   2. The General Conditions for the Project are Specification 007200, "General Conditions of the contract for Construction," Construction Manager as Adviser Edition (AIA A232-2019).

B. Bid Form: Section 004113 "Bid Form" is bound in these Specifications. Submit exact form per Section 001116 "Invitation to Bid."

C. Contractor is hereby specifically directed, as a condition of the contract, to obtain necessary number of copies of AIA Document A232–2019 to acquaint themselves with the Articles contained therein and to notify and apprise Subcontractors, suppliers, and other parties to the contract or individuals or agencies engaged on Work as to its contents.

D. No contractual adjustment shall be due or requested as a result of failure on part of Contractor to fully acquaint themselves and other parties to the contract with conditions of AIA Document A232–2019.

1.2 ADMINISTRATIVE FORMS

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

B. Copies of AIA Documents may be reviewed at Architect's office or obtained through the following website: http://www.aia.org/contractdocs/index.htm

C. Preconstruction Forms:
   1. Form of Bid Bond: AIA Document A310–2010, Bid Bond
   2. Form of Performance Bond and Labor and Material Bond: AIA Document A312–2010, Performance Bond and Payment Bond.

D. Information and Modification Forms:
   1. Form for Requests for Information (RFIs): AIA Document G716–2004, Request for Information (RFI) or other forms as provided by Program Construction Manager.
   2. Form of Request for Proposal: AIA Document G709–2018, Work Changes Proposal Request or other forms as provided by Program Construction Manager.
   3. Change Order Form: AIA Document G731–2019, Change Order.
   4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710–2017, Architect's Supplemental Instructions.
   5. Form of Change Directive: AIA Document G733-2019, Construction Change Directive Construction Manager – Adviser Edition.

E. Payment Forms:
   1. Schedule of Values Form: AIA Document G703–1992, Continuation Sheet.
   2. Payment Application: AIA Document G732–2019, Application and Certificate for Payment, Construction Manager as Advisor Edition.
   3. Form of Contractor's Affidavit: AIA Document G706–1994, Contractor's Affidavit of Payment of Debts and Claims.
   4. Form of Affidavit of Release of Liens: AIA Document G706A–1994, Contractor's Affidavit of Payment of Release of Liens.
   5. Form of Consent of Surety: AIA Document G707–1994, Consent of Surety to Final Payment.

6. Form of Consent of Surety: AIA Document G707A–1994, Consent of Surety to Final Reduction in or Partial Release of Retainage.

F. Substantial Completion Forms:
   1. Form of Substantial Completion: AIA Document G734-2019, Certificate of Substantial Completion, Construction Manager – Advisor Edition.

END OF SECTION 006000

CLINTON-GRACEVILLE BEARDSLEY SCHOOLS
2025 ADDITION & RENOVATIONS
SECTION 006325 – SUBSTITUTION REQUEST FORM

PROJECT: Clinton-Graceville Beardsley Schools 2025 Addition & Renovations

TO: _____

Program Construction Manager: SitelogIQ, Inc. Date: _____

From: ____

Substitution Request No.: _____

Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason Substitution is Being Submitted (Select 1 of the following):

- ☐ Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specification Section showing differences.
- ☐ Specified product is not available. Explain in detail using attached letter.
- ☐ Cost savings to Owner. Indicate comparative cost analysis as attachment.
- ☐ Other. Explain: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($_____)
(Description. i.e. ONE THOUSAND DOLLARS AND NO CENTS) (Number)
[Add] [Deduct] [No Change] - circle one

Proposed substitution changes Contract Time: ☐ No ☐ Yes Number of days____

Supporting Data Attached:

☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

Construction Project Manager Action

☐ Accepted ☐ Accepted as Noted ☐ Not Accepted ☐ Received Too Late

☐ Incomplete Information ☐ No substitutions accepted for this

Comments: _____

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer

_____

_____

_____

_____

END OF SECTION 006325

AIA® Document A232™ – 2019

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

SECTION 007200 –
AIA Contract Document

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

Clinton-Graceville Beardsley Schools
2025 Addition & Renovations
712 East 3rd Street
Graceville, MN 56240

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

SitelogIQ, Inc
7900 W 78th St, Suite 400
Edina, MN 55439

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

Clinton-Graceville Beardsley District 2888
601 1st Street
Clinton, MN 56225

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

DesignArc Group
434 5th Street, Suite 1
Brookings, SD 57006

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

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

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

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TABLE OF ARTICLES

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

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

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Owner and the Program Construction Manager or the Program Construction Manager's consultants, (2) between the Contractor and the Program Construction Manager or the Program Construction Manager's Consultant, (3) between the Owner and a Subcontractor or Sub-subcontractor, or (4) between the Program Construction Manager or Program Construction Manager's consultants and any Subcontractor or Sub-subcontractor, or (5)between any persons or entities other than the Owner and Contractor. The Program Construction Manager 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.

§ 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 Program 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 Program 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 Program Construction Manager and the Program Construction Manager's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.10 Initial Decision Maker. The Initial Decision Maker is the Program Construction Manager. When acting as the Initial Decision Maker, the Program Construction Manager shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.1.11 References to Program Construction Manager. DesignArc Group serves as the Architect. Architect is a consultant of Program Construction Manager.

§ 1.1.12 Warranty. The term "Warranty" and "Guarantee" may be used interchangeably in the Contract Documents. Warranty shall mean the integrity of a product and Contractor's or Manufacturer's responsibility to the repair or replacement of defective part or parts, including labor associated with such repair or replacement.

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

§ 1.2.3 Execution of the Contract by the Contractor is a representation that the Contractor:

§ 1.2.3.1 Has visited the site and investigated the nature, location, general and local conditions of the Work and area which can affect the Work or its cost.

§ 1.2.3.2 Has examined all Bidding documents in relation to each other and to the Project site, the existing structure and grounds, the obstacles, which may be encountered, and all other conditions having a bearing upon the performance of the work, Supervision of the Work, existing conditions, time of completion, costs, and all other relevant matters.

§ 1.2.3.3 Has obtained clarifications for all inconsistencies, errors, omissions, or other conditions having a bearing upon the performance of the Work, Supervision of the Work, time of completion, costs, and all other relevant matters.

§ 1.2.4 Failure of the Contractor to perform any of the items in Section 1.2.3 shall not result in additional compensation.

§ 1.2.5 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.

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

.1 Modifications
.2 The Agreement.
.3 Addenda, with those of later date having precedence over those of earlier date.
.4 The Supplementary Conditions.
.5 The General Conditions of the Contract for Construction.
.6 Division 01 of the Specifications.
.7 Drawings and Divisions 02-49 of the Specifications.
.8 Other documents specifically enumerated in the Agreement as part of the Contract Documents.

§ 1.2.7 In the case of conflicts or discrepancies between Drawings and Divisions 02 through 49 of the Specifications or within or amount the Contract Documents and not clarified by Addendum, the Program Construction Manager will determine which takes precedence per Sections 4.2.15 through 4.2.17.

§ 1.2.8 Discrepancies that are discovered in or between the Drawings and Specifications: The Contractor is deemed to have estimated their costs on the more expensive material or method of doing the modified Work, unless the Contractor has received a written decision from the Program Construction Manager clarifying which material or method to perform the Work will be required.

§ 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 Program Construction Manager and the Program Construction Manager'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 Program Construction Manager's or Program Construction Manager'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, Program Construction Manager, and Program Construction Manager'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 mail (e-mail).

§ 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, by courier providing proof of delivery, or e-mail. Notice of Claims must also be sent via e-mail to legal@sitelogiq.com.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E202™–2022, Building Information Modeling (BIM) Exhibit – Project-Wide Sharing Where Model Versions May Not be Enumerated as a Contract Document, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E202™–2022, BIM Exhibit – Project-Wide Sharing Where Model Versions May Not be Enumerated as a Contract Document, and the requisite AIA Document G203™–2022, BIM Execution Plan, shall be

at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen (15) days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce Contractor's right to payment.

§ 2.2 Evidence of the Owner's Financial Arrangements

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

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen (14) days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, assisted by the Program Construction Manager, shall secure and pay for the building permit. If applicable the Owner will pay for Health Department fees, Special Testing Program Inspector fees, and Metropolitan Waste Control Commission fees (Sewer Availability Charge/Water Availability Charge).

§ 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 Program Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 The Owner shall retain a Program Construction Manager adviser lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Program 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 Program Construction Manager terminates, the Owner shall employ a successor Program Construction Manager and architect to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Program Construction Manager and/or architect, respectively.

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

§ 2.3.6 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.

§ 2.3.7 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one (1) copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2. The Contractor may obtain additional sets from the Program Construction Manager at a cost of reproduction, handling, and mailing. The charges are non-refundable to the Contractor.

§ 2.3.8 The Owner shall forward all communications to the Contractor through the Program Construction Manager. Other communication shall be made as set forth in Section 4.2.5.

§ 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 (10) 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 and approval by the Program Construction Manager. The Program Construction Manager 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 Program Construction Manager's and its 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 or the Program Construction Manager, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the

jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.5, 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 Program Construction Manager any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Program Construction Manager in such form as the Program Construction Manager may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Program Construction Manager issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner 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 Program Construction Manager 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 No change in the Contract Sum will be allowed because of minor differences between actual field conditions and those associated in the Contract Documents. Information on the Drawings are diagrammatic.

§ 3.2.6 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Program Construction Manager, Architect, or both for evaluating and responding to the Contractor's requests for information where the requested 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or

procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Program Construction Manager, and shall propose alternative means, methods, techniques, sequences, or procedures. The Program Construction Manager shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction and review the proposed alternative for sequencing, constructability, and coordination impacts on the other Contractors. Unless the Program 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.

§ 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.

§ 3.3.4 Safety is solely the responsibility of the Contractor to possess, implement, and monitor a safety program in accordance with public contract law and OSHA rules and regulations. Although the Program Construction Manager advises the Owner, the Owner or Program Construction Manager reserves the right to stop the Work due to safety concerns. This Section 3.3.4 includes removing the Contractor or its Subcontractors' employees from the project site if they are non-conforming to the safety rules or committing an unsafe act. Any removal of a Contractor or Contractor's Subcontractor' employee does not constitute any responsibility for, control over, construction means, methods, techniques, sequences, and procedures, or coordination of Contractor's Work.

§ 3.3.5 The Contractor, Subcontractor, and other persons or entities performing portions of the Work for, or on behalf of the Contractor shall attend meetings as requested and scheduled by the Program Construction Manager.

§ 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 Program Construction Manager in accordance with Section 3.12.8 or ordered by the Program Construction Manager in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation and consultation by the Program Construction Manager, and in accordance with a Change Order or Construction Change Directive.

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

§ 3.4.4 Local custom and trade-union jurisdictional settlements do not control the scope of Work included in each Contract. When a potential jurisdictional dispute or similar interruption of construction activities is first identified or threatened, the affected Contractors shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruptions and its delay. The Contractor shall be bound by the agreement establishing the impartial jurisdictional disputes board and/or its successors. The Contractor agrees not to cause a Work stoppage or slow down due to jurisdictional assignment of Work. The Contractor agrees to maintain an adequate workforce of experienced workers and the necessary materials, supplies, and equipment to meet the requirements of the Program Construction Manager and other trades in order to maintain the construction schedule. In the event that their forces are, in the judgment of the Program Construction Manager, inadequate to meet the established schedules during regular working hours, the Contractor agrees to perform overtime Work or increase its workforce to meet such schedules at no extra cost to the Program Construction Manager or Owner.

§ 3.4.5 Where a product is specified by manufacturer or brand name, it shall be understood this designation is used to establish the minimum standard of quality required, and the published data, including the manufacturer's extended warranties, pertinent to this product shall be considered a requirement of the Contract Documents.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Program Construction Manager 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 Program Construction Manager, 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.

§ 3.5.3 The Contractor also warrants that all products will be installed in a satisfactory manner. The Contractor's Warranty includes features unique to a specific product or assembly not specifically indicated in the Drawings or Specifications, or different from those indicated. The Contractor's Warranty further includes the payment of any additional costs by others for Work to bring Work into conformance with the unique requirements of any such product.

§ 3.5.4 Warranties provided are in addition to, not in lieu of, the Contractor's general Warranty. The Contractor's general Warranty obligation is not reduced or released by the specification of a particular product, procedure or manufacturer's Warranty.

§ 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.

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

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

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

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

§ 3.7.4 Local/State Codes and Permits. All work shall be done in accordance with the International Building Code or other similar code adopted by the city in which the Work shall be performed, and all applicable city, county, and state ordinances in the city, county, and state in which the Work shall be performed. The Contractor shall obtain all special permits required to complete their Work. Each Contractor shall pay for all special permits, bonds, licenses, and fees as required by the city or state in which the Work shall be performed, or as stated in the Contract Documents.

§ 3.7.5 Inspections. Each Contractor shall be responsible to notify, scheduling and pay for all inspections required by the authority having jurisdiction and Contract Documents.

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

§ 3.7.7 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Program Construction Manager. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents:

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

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

§ 3.9 Superintendent

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

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

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

§ 3.9.4 The Program Construction Manager has the authority to remove any employee, including the superintendent of a Contractor or its Subcontractor(s). Upon written direction of the Program Construction Manager, Contractor shall replace designated personnel and maintain contract completion date. The Program Construction Manager's removal of an employee of Contractor or Contractor's subcontractor does not constitute responsibility for, control over, construction means, methods, techniques, sequences, and procedures, or coordination of Contractor's Work.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 No greater than two (2) weeks after the award of the contract, the Contractor shall submit for the Owner's and Program Construction Manager's information, and the Program 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 monthly or as otherwise requested by the Owner, Program Construction Manager, or Architect. The Contractor shall cooperate with the Program 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. Each monthly update of the schedule shall include a narrative including:

.1 A description of the status of the schedule;
.2 A discussion of current and anticipated delays;
.3 A discussion of progress of critical path activities;
.4 A discussion of the critical path for the remainder of the Project; and
.5 A listing and discussion of logic changes and duration changes.

§ 3.10.2 Schedule will be provided to the Program Construction Manager in electronic Microsoft Project format, and include all successor activities, predecessor activities, and be resource loaded.

§ 3.10.3 Activities shall be no longer than two (2) calendar weeks in duration. Equipment procurement activities are permitted longer in duration if all activities associated (submittals, etc.) are tasked out as separate activities.

§ 3.10.4 Schedule will be updated and submitted by the Contractor for Owner and Program Construction Manager review no greater than two (2) times a month.

§ 3.10.5 The Contractor, promptly (but no more than fourteen (14) days) after being awarded the Contract, and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Program Construction Manager's approval. The Program 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 Program Construction Manager 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.

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

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

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data, and Samples

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Program Construction Manager is subject to the limitations of Sections 4.2.9 and 4.2.10. Informational submittals upon which the Program Construction Manager 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 Program Construction Manager without action.

§ 3.12.5 Within fourteen (14) days after the Contract date or notice to proceed, whichever is later, the Contractor shall review for compliance with the Contract Documents, approve, and submit to the Program 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 Program Construction Manager 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 Program 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 and Program Construction Manager 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 Program Construction Manager.

§ 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 Program Construction Manager's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Program Construction Manager of such deviation at the time of submittal and (1) the Program Construction Manager 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 Program Construction Manager'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 Program Construction Manager on

previous submittals. In the absence of such notice, the Program Construction Manager'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 Program Construction Manager will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Program Construction Manager. The Owner and the Program 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 Program Construction Manager have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Program Construction Manager will review and approve or take other appropriate action on submittals to check for conformance with information given and the design concept expressed in the Contract Documents, and 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 Program Construction Manager at the time and in the form specified by the Program Construction Manager.

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

§ 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 Program Construction Manager before using any portion of the site.

§ 3.13.3 The project site will be in use during the school term. Work must be coordinated with the Owner for each individual school through the Program Construction Manager. Care, custody and control of the site shall be vested in the Contractor, subject to the rights of the Owner. Schedule phasing of the Work must not interfere with the program of the school. Shift Work may be necessary. The delivery and storage of materials will be coordinated through Program Construction Manager.

§ 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 Program 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. The Contractor shall provide labor as directed by the Owner or Program Construction Manager for construction site clean-up on a weekly, or if required, more frequent basis. All packaging/crating materials from goods installed will be removed from the site by the Contractor responsible for taking delivery of the materials. The Contractor responsible for taking delivery of Owner furnished materials, if any, will be responsible for packing/crating of goods delivered. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

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

§ 3.15.3 Removal of snow, water, dirt, dust, or other debris accumulated in the designated Work areas is the responsibility of Contractor.

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Program Construction Manager harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Program Construction Manager. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Program Construction Manager.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Program Construction Manager, and Program Construction Manager'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 but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

§ 3.18.3 The obligations of Contractor under this Section 3.18 shall survive the expiration or termination of the contract and shall extend to claims, damages, losses, liabilities and expenses asserted or arising after completion of the Work as well as during the Work progress.

§ 3.18.4 When the Owner is joined as a party defendant in any aforementioned suit or suits, action or actions, on account of any aforementioned claim or claims for any such injuries or damages arising therefrom or connected with the Work, the Contractor shall be obligated to fully indemnify and hold harmless the Owner from all liability therein and to further accept the tender of the defense of any suit or suits, action or actions, at the Contractor's own separate cost and expenses, and if Contractor, in any such instance or instances, shall unduly fail or refuse upon due notice and demand as the same may be given by the Owner in the sum on account, and in addition to all other liability of the Contractor to the Owner in sum on account and as, and for reimbursement for the Owner's costs and expenses in providing such defense, compiled and set forth herein as follows:

§ 3.18.4.1 One hundred fifty dollars ($150.00) in each instance where the Owner is made a party to an action or is brought into a pending action as an additional party to third party defendant, the same amount being established as a reasonable attorney's fee for appearing in any action.

§ 3.18.4.2 All actual costs incurred by the Owner in participating in such action, including but not limited to investigative expenses, expert costs, and any costs of the Owner by reason of any discovery procedure undertaken in such action.

§ 3.18.4.3 Reasonable attorney's fees for any appearance in Court, these fees being the same as those established by the minimum fee schedule for the state bar association, per day for municipal court, district court, the state court of appeals, the state supreme court, and corresponding amounts for courts and commissions of comparable jurisdiction.

§ 3.18.4.4 The Owner may retain any amount due under the Contract or any amount which shall become due under the Contract in satisfaction of any costs or charges incurred by the Owner in accordance with the foregoing schedule of charges when the Owner is required to participate in any lawsuits arising out of or caused as a result of the operations of the Contractor in performance of the Contract.

§ 3.18.4.5 The Contractor shall immediately notify the Program Construction Manager in writing of the existence of any claims, other than those arising under the Workers' Compensation Act, or possible claims either because of personal injury or property damage, which claims arise as a result of the performance of Contractor's Work or the Work of its Subcontractor(s).

§ 3.18.4.6 The Owner is to be indemnified against the Contractor's failure to abide by the law and provisions of this Contract as they pertain to a state's Employee Right to Know Act. This indemnification applies to the Owner, its employees, agents, consultants, and building occupants, whether incidental to this Project or not.

ARTICLE 4 PROGRAM CONSTRUCTION MANAGER

§ 4.1 General

§ 4.1.1 The Program Construction Manager is the person or entity retained by the Owner pursuant to Sections 2.3.2 and 2.3.3 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

§ 4.2.1 The Program Construction Manager 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 Program Construction Manager issues the final Certificate for Payment. The Program Construction Manager will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Program Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Program Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner reasonably informed of the progress of the Work, and will promptly report to the Owner known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work. However, the Program Construction Manager will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

§ 4.2.3 The Program Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project schedule.

§ 4.2.4 The Program Construction Manager 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. The Program Construction Manager will not 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.

§ 4.2.5 Communications. The Owner shall communicate with the Contractor and the Program Construction Manager's consultants through the Program Construction Manager about matters arising out of or relating to the Contract Documents. Communications by and with the Program Construction Manager's consultants shall be through the Program Construction Manager. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with other Contractors shall be through the Program 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. Direct communications between the Program Construction Manager and the Contractor that affect the performance or administration of the Work shall be made or confirmed in writing.

§ 4.2.6 The Program Construction Manager will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.7 The Program Construction Manager has authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. Whenever the Program Construction Manager considers it necessary or advisable, the Program 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 Program Construction Manager will be subject to the provisions of Sections 4.2.16 through 4.2.18 inclusive. However, the Program Construction Manager's authority to act under this Section 4.2.7 nor a decision made by the Program Construction Manager in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Program Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.8 Utilizing the submittal schedule provided by the Contractor, the Program 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 Program Construction Manager. The Project submittal schedule and any revisions thereto shall be submitted to the Program Construction Manager for approval.

§ 4.2.9 The Program 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 Program Construction Manager will also check and coordinate the information contained within each submittal received from the Contractor and other Contractors. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Program Construction Manager represents to the Owner that the Program Construction Manager has reviewed and approved them.

§ 4.2.10 Review of the Contractor's submittals by the Program Construction Manager 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 Program Construction Manager'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 Program Construction Manager's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Program Construction Manager's approval of a specific item shall not indicate approval of an assembly of which the item is a component. The Program

Construction Manager will review the initial submittal and one (1) re-submittal. If further review is required on more than one (1) re-submittal (i.e. second, third or more re-submittal) the Program Construction Manager will do so on an hourly basis. The Program Construction Manager will then charge the Owner for this additional service (as provided in the Agreement between the Owner and Program Construction Manager) and the Owner will then deduct the sum due for those additional services occasioned by excessive re-submittals from the amount due to the Contractor at the next application for payment. In addition, if submittals are provided either incomplete or requiring other submittals in order to conduct an appropriate review, and the Contractor requests review of these "incomplete" submittals, they will be reviewed on an hourly basis as set forth above.

§ 4.2.11 The Program Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.12 The Program Construction Manager will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7, and the Program Construction Manager will have authority to order minor changes in the Work as provided in Section 7.4. The Program Construction Manager will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.13 Utilizing the documents provided by the Contractor, the Program Construction Manager will maintain at the site for the Owner one (1) 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 Contractor and will be delivered to the Owner upon completion of the Project.

§ 4.2.14 The Program Construction Manager will determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion 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 Program Construction Manager will forward to the Owner 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.

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

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

§ 4.2.17 Interpretations and decisions of the Program Construction Manager 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 Program Construction Manager 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.

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

§ 4.2.19 The Program Construction Manager will receive and review requests for information from the Contractor, and review and respond in writing to requests for information about the Contract Documents. The Program Construction Manager's response to each request will be made in writing within any time limits agreed upon or otherwise within fourteen (14) days. If appropriate, the Program Construction Manager will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term Subcontractor shall also include material and equipment suppliers that directly contract with the Contractor. 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, the Contractor, as soon as practicable after award of the Contract, shall notify the Program Construction Manager, for review by the Owner and Program Construction Manager, 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 fourteen (14) days of receipt of the information, the Program Construction Manager may notify the Contractor whether the Owner or Program Construction Manager (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Program Construction Manager to provide notice within the fourteen (14) day period shall constitute notice of no reasonable objection. However, failure of the Owner or Architect or Program Construction Manager to reply is not tacit approval and does not relieve the Contractor of responsibility for the conduct of Contractor's Subcontractors and Contractor's Work. The Contractor shall properly direct and control their Subcontractors.

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

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

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

§ 5.3 Subcontractual Relations

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

be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction 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, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

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

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Separate Contractors, Program 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 Program Construction Manager 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 Program Construction Manager of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractors or other Contractors that are not apparent.

§ 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 Program Construction Manager 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, Program Construction Manager, and Contractor. A Construction Change Directive requires agreement by the Owner and Program Construction Manager 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 Program Construction Manager alone.

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

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Program Construction Manager and signed by the Owner, Program Construction Manager, 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;
.3 The extent of the adjustment, if any, in the Contract Time; and
.4 The combined overhead and profit by Contractor and Subcontractors included in the total cost to the Owner shall not exceed the percentages mentioned in Section 7.3.11.

§ 7.2.2 All Change Orders are to be approved prior to proceeding with the change in the Work. Change made by the Contractor without prior approval are made at the Contractor's Expense. Changes required on an emergency basis will be authorized verbally by the Owner and later confirmed by a memorandum from the Contractor within twenty-four (24) hours. Written approval shall be issued for all Change Orders.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Program Construction Manager and signed by the Owner and Program Construction Manager, 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;
- **.4** Indirect costs, whether on or off site (included as Contractor's overhead); or
- **.5** As provided in Section 7.3.4.

§ 7.3.4 In the event the Contractor disputes any Contract Sum adjustment or Contract Time adjustment resulting from any Construction Change Directive, Contractor shall submit a written notice to the Program Construction Manager stating its proposed Contract Sum adjustment and the basis thereof, within seventy-two (72) hours of the issuance of the written Construction Change Directive. If the Contractor does not provide written notice within seventy-two (72) hours to the Construction Change Directive, Contractor shall be deemed to have waived its rights to dispute or contest the Construction Change Directive and the changes implemented thereby. If Contractor disagrees with the method for adjustment in the Contract Sum, the Program 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 section 7.3.11. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Program 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 Program Construction Manager;
- **.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 advise the Program Construction Manager of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. If the Contractor agrees with the method provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time, Contractor shall promptly proceed with the change in the Work. If the Contractor disagrees with the method provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time, Contractor shall provide the basis of its dispute in its notice provided to the Program Construction Manager pursuant to Section 7.3.4.

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

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Program Construction Manager. 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 Program Construction Manager will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Program Construction Manager 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 Program Construction Manager 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 Program Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 In Paragraph 7.3.4, the allowance for overhead, bond, insurance, field supervision, and profit shall be ten percent (10%) of the cost of labor, labor insurance and materials for Work performed by the Contractor's own employees and five percent (5%) of the Subcontractor's invoice for Work performed by Contractor's Subcontractors. A breakdown of material and hourly breakdown of labor shall be submitted with each request for additional compensation.

§ 7.3.12 Not more than the percentages mentioned in Section 7.3.11 or a combined maximum of ten percent (10%) for overhead, profit or commission will be allowed to be added to the basic cost regardless of the number of tiers of Contractors, Subcontractors, or Sub-Subcontractors.

§ 7.3.13 The percentage allowed for overhead and profit under Section 7.3.11 shall be deemed to include, but not limited to: (1) general insurance except that listed as the labor burden; (2) wages of field and office supervision and administration, including the field superintendent and non-working foreman; (3) use or replacement of hand tools; (4) shop burden; (5) average job engineering; (6) stakeout and layout; (7) incidental job burdens; (8) general office expenses; (9) including such costs when related to reasonable extension of time, if extension of Contract Time is necessary because of changes; (10) cost of safety measures (including those imposed by OSHA); (11) permits, unless a new permit type is required; and (12) any other costs except those enumerated in Section 7.3.4.

§ 7.3.14 For Construction Change Directive changes resulting in a credit in the basic costs, a reasonable allowance for overhead or profit will be required to be credited the Owner, as approved by the Program Construction Manager. In general, no credit for overhead or profit will be required where the net change credit is minor or where the change in Work indicates that it is reasonable that no credit be allowed to the Owner due to the effort, cost, or responsibility of the Contractor. In the event of substantial subcontract credits, or for Work the Contractor does not provide or perform, a reasonable overhead and profit credit shall be allowed to the Owner, as determined by the Program Construction Manager. If the Contractor or Owner disagree with the Program Construction Manager's determination under this Section 7.3.14, the Contractor or Owner shall submit a Claim pursuant to Article 15.

§ 7.3.15 After execution of Contract, substitutions for specified materials constitute "change in the Work" and may be proposed by Contractor only on the condition that either:

.1 The specified material cannot be delivered and incorporated into the Work in the time allowed due to conditions beyond the control of the Contractor; or

.2 The Owner will benefit by a reduced cost or an improved Project.

§ 7.3.16 If any change is implemented pursuant to Section 7.3.15, the Owner shall receive the full benefit of any cost reductions. The Contractor shall reimburse the Owner for costs of the Program Construction Manager's investigation of the substitutions.

§ 7.3.17 All proposals for extras or credits shall be accompanied by a complete itemization of costs in accordance with section 7.3.4.

§ 7.4 Minor Changes in the Work

The Program Construction Manager 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 Program Construction Manager'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 Program Construction Manager and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Program Construction Manager's order for a minor change without prior notice to the Program 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 Program Construction Manager in accordance with Section 9.8.

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

§ 8.2 Progress and Completion

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

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

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion and Final Completion within the Contract Time specified. If Contractor's Work falls behind schedule for reasons that are not excused under the terms of the Contract, Contractor shall add additional workers or shifts, and/or work overtime as necessary to maintain the Construction Schedule. The Work shall not be suspended or shut down but shall progress continuously with sufficient labor and supervision at all times unless otherwise approved by the Owner.

§ 8.2.4 The Contractor must conform to the most recently approved Construction Schedule. The Contractor must complete the indicated Work or achieve the required percentage of completion, as applicable, within any interim completion dates established in the most recently approved Construction Schedule.

§ 8.2.5 The Contractor represents that its bid includes all costs, overhead and profit which may be incurred throughout the Contract Time and the period between Substantial and Final Completion. Accordingly, the Contractor may not make any claim for delay damages based in whole or in part on the premise that the Contractor would have completed the Work prior to the expiration of the Contract Time but for any claimed delay.

§ 8.2.6 If the Contractor's progress is not maintained in accordance with the approved Construction Schedule, or the Owner determines that the Contractor is not diligently proceeding with the Work or has evidence reasonably indicating that the Contractor will not be able to conform to the most recently approved Construction Schedule, the Contractor must, promptly and at no additional cost to the Owner, take all measurers necessary to accelerate its progress to overcome the delay and ensure that there will be no further delay in the progress of the Work and notify the Owner.

§ 8.2.7 The Owner reserves the right to issue a written directive, through the Program Construction Manager, to accelerate the Work that may be subject to an appropriate adjustment, if any, in the Contract Sum. If the Owner requires an acceleration of the Construction Schedule and no adjustment is made in the Contract Sum, or if the Contractor disagrees with any adjustment made, the Contractor must file a claim as provided in Article 15 or the same will be deemed to be conclusively waived.

§ 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, Program 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 resolution; or (5) by other causes that the Contractor asserts and the Program Construction Manager determines justify delay, then the Contract Time shall be extended for such reasonable time as the Program Construction Manager may determine.

§ 8.3.1.1 If in the opinion of the Program Construction Manager, the Work is behind where it is supposed to be in the Project Time Schedule or it is likely that the Work will not be substantially complete by the applicable date for Substantial Completion, the Contractor, upon written notice from the Program Construction Manager and without additional cost or compensation, will increase its work force and, if requested by the Program Construction Manager, work such overtime to make up for the delay. Should the Contractor fail to increase its work force, work overtime, or proceed to make up for the delay to the satisfaction of the Program Construction Manager or the Owner, the Program Construction Manager or Owner, in addition to other remedies under the Contract Documents, will have the right to cause other Contractors to work overtime and to take any other action deemed necessary to avoid delay in the Substantial Completion of the Work and of the Project, and the cost and expense of such overtime and other action will be borne by the Contractor and may be offset against sums due the Contractor.

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

§ 8.3.3 Owner owns all float in the Contract Time. Contractor shall not receive compensation for any claims relating to float.

§ 8.3.4 Upon receipt of a notice to proceed, the Contractor shall begin construction operations and continuously and effectively prosecute the Work with the least possible delay in order to complete all Work and all cleanup within the Contract Time, taking into consideration all restrictions or limitations to the construction procedures hereinafter specified.

§ 8.3.5 The Contractor shall be responsible for damages incurred by the Owner and Separate Contractors for delay resulting form the Contractor's failure to complete the Work within the contract time indicated in the Agreement. Losses may include additional administrative costs, rental costs for required off-site classroom space, additional custodial costs, and professional fees.

§ 8.3.6 Should the Contractor fail to complete the Work within the Contract Time indicated in the Contract Documents, the Contractor may be assessed a daily charge commensurate to the losses, damages, or both incurred by the Owner. The charges shall be on a calendar day basis for each calendar day that the Work is not substantially compete beyond the Contract Time. Damages shall be credited to the Owner in the form of a Change Order or deducted from the final Contract Sum.

§ 8.3.7 No interruption, interference, inefficiency, suspension or delay in the commencement or progress of the Work for any cause whatsoever, including those for which Owner, Owner's design professionals, Program Construction Manager, Separate Contractors, or other Contractors may be responsible, in whole or in part, shall relieve Contractor of its duty to perform in accordance with the terms, conditions and requirements of the Agreement. Subject to the provisions of this Section 8.3, Contractor shall be entitled to seek additional time for the performance of its Work, but the Contractor shall not be entitled to, and hereby waives and releases any right to, additional compensation for such interruptions, interferences, inefficiencies, suspensions, or delays. Should Contractor be delayed in the prosecution of its Work by the occurrence of any act for which Contractor is not responsible, the time fixed for completion of Contractor's Work shall be extended for a period of time equal to the time lost by the Contract resulting form such a delay. Contractor shall not be entitled to any time extension unless a notice of claim for such time extension is presented in writing to the Program Construction Manager within three (3) days of the first occurrence of the delay and the Program Construction Manager approves the Contractor's claim in writing. Contractor agrees that an extension of time for completing its Work precludes any and all other claims Contractor has or may have against the Owner on account of such delay.

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Program Construction Manager within five (5) days after receipt of the Contract and prior to submitting 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 Program Construction Manager. Parts of the Work shall be broken down into labor, material, and equipment with no line item total greater than $75,000 (except for large equipment). The schedule of values shall include a line item for clean-up in an amount appropriate for the Contractor's Work. The schedule of values for Divisions 23 "Temperature Controls Contractor" shall include a line item for functional testing/verification and be scheduled at fifteen percent (15%) of the total bid amount of the temperature control package. This schedule, unless objected to by the Program Construction Manager, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Program Construction Manager and supported by such data to substantiate its accuracy as the Program Construction Manager may require, and unless objected to by the Program Construction Manager, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 Contractor shall submit an Application for Payment by following the procedures laid out in this section 9.3.1.

§ 9.3.1.1 Once approved, the schedule of values shall be used on subsequent Applications for Payment through the end of the Project.

§ 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 shall be submitted to the Program Construction Manager in triplicate by the first of each month with the previous month's costs. The Applications for Payment shall be completely filled out, notarized, and bear the Contractor's signature. Applications shall include items incorporated into the Project or stored on-site. This includes updating of Record Drawings on a monthly basis. Applications will not be processed until Record Documents are updated.

§ 9.3.1.4 Contractor shall submit Applications for Payment and its schedule of values on AIA forms G732-2019 and G 703-1992, respectively. Applications for Payment shall delineate retention in the amount indicated in other Contract Documents for each line item and in total for the Project through completion of the approved value of the Work performed under the Contract as of the date of the Application for Payment until final completion and acceptance of Work covered by the Contract. To the extent permitted by law, Contractor shall not be paid interest on retained amount. A sample copy is included following the end of this document.

§ 9.3.1.5 Contractor shall attach a conditional lien waiver to it Applications for Payment.

§ 9.3.1.6 Applications for Payment not submitted by the first of each month or not meeting the criteria outlined in this Section 9.3 will be rejected and resubmitted the following month.

§ 9.3.1.7 Retention is the Owner's assurance that Work is functional upon completion. Retention will not be used to account for costs associated with "punch list or deficiency list" items. Listed items depict incomplete Work, and thus, not accounted for on the Application for Payment.

§ 9.3.1.8 Until substantial completion, the Owner will pay 95 percent (95%) of the amount due to the Contractor on progress payments. The scheduled value for Division 23 "Temperature Controls Contractor" functional testing/verification will only be paid after work for this item has been fully completed and verified by the commissioning agent(s).

§ 9.3.1.9 The Contractor may, at his option, deposit bonds or securities with Owner or in any bank or trust company, approved by the Owner and Program Construction Manager to be held in lieu of cash retainage for the benefit of the Owner. Such deposits must be made in conjunction with and at the same time as the Application for Payment. Proof of such deposits must accompany said Application for Payment. In that event, the Owner shall reduce the retainage in an amount equal to the value of the bonds and securities and pay the amount of the reduction to the Contractor.

§ 9.3.1.10 Interest on the bonds or securities shall be payable to the Contractor as it accrues. Bonds and securities deposited or acquired in lieu of retainage shall be of a character approved by the Owner including but not limited to:

.1 bills, certificates, notes or bonds of the United States;
.2 other obligations of the United States or its agencies;
.3 obligations of any corporation wholly owned by the federal government; or
.4 indebtedness of the Federal National Mortgage Association.

§ 9.3.1.11 If the Owner incurs additional costs as a result of the option described in Sections 9.3.1.9 and 9.3.1.10, the Owner may recover the costs from the Contractor by reducing the final payment due under the Contract. As Work on the Contract progresses, the Owner shall, upon demand, inform the Contractor of all accrued costs.

§ 9.3.1.12 A progress payment shall not be considered acceptance or approval of any Work or waiver of any defect therein.

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

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

§ 9.4 Certificates for Payment

§ 9.4.1 Where there is only one (1) Contractor, the Program Construction Manager will, within fourteen (14) days after the Program Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Program Construction Manager determines is due the Contractor, and will either (1) issue to the Owner a Certificate for Payment, in the full amount of the Application for Payment, (2) issue to the Owner a Certificate for Payment for such amount as the Program Construction Manager determines is properly due, and notify the Owner of the Program Construction Manager'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 Owner of the Program Construction Manager's reason for withholding certification in whole as provided in Section 9.5.1. The Program Construction Manager will provide Contractor a notice of withholding certification.

§ 9.4.2 Where there is more than one (1) Contractor performing portions of the Project, the Program Construction Manager will, within fourteen (14) days after the Program Construction Manager receives all of the Contractors'

Applications for Payment: (1) review the Applications and certify the amount the Program 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 Project Application and Certificate for Payment; and (4) certify the amount the Program Construction Manager determines is due all Contractors. The Program Construction Manager will also either (1) issue to the Owner a Project Certificate for Payment, (2) issue to the Owner a Project Certificate for Payment for such amount as the Program Construction Manager determines is properly due and notify Owner of the Program Construction Manager'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 Owner of the Program Construction Manager's reason for withholding certification in whole as provided in Section 9.5.1. The Program Construction Manager will provide a notice of withholding certification to the Contractors.

§ 9.4.3 The Program Construction Manager's certification of an Application for Payment or a Project Application and Certificate for Payment shall be based upon the Program Construction Manager's evaluation of the Work and the data in the Application or Applications for Payment. The Program Construction Manager's certification will constitute a representation that, to the best of the Program 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 representations made pursuant to Section 9.4.3 is 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 Program Construction Manager.

§ 9.4.5 The issuance of a Certificate for Payment or a Project Certificate for Payment will not be a representation that the Program Construction Manager 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 Program Construction Manager 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 Program Construction Manager's opinion the representations to the Owner required by Section 9.4.3 cannot be made. If the Program Construction Manager is unable to certify payment in the amount of the Application for Payment, the Program Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.2. If the Contractor and Program Construction Manager cannot agree on a revised amount, the Program Construction Manager will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Program Construction Manager is able to make such representations to the Owner. The Program Construction Manager 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 Program Construction Manager'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;
- **.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** failure to carry out the Work in accordance with the Contract Documents.

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

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

§ 9.5.4 If the Program 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 Program Construction Manager, which shall be reflected on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Program Construction Manager 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 Program Construction Manager.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven (7) 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 Program 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, Program Construction Manager 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 amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven (7) days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Program Construction Manager 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 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.

§ 9.6.6 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 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.

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

§ 9.7 Failure of Payment

If the Program Construction Manager does not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, within fourteen (14) days after the Program Construction Manager's receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract Documents, the amount certified by the Program Construction Manager or

awarded by binding dispute resolution, then the Contractor may, upon seven (7) additional days' notice to the Owner and Program Construction Manager stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. If the Work, or portion thereof, is to be followed by construction by the Owner, or by a Separate Contractor, Substantial Completion shall be defined as the readiness of the Work for the commencement of such Owner or Separate construction. Startup verification tests, testing and balancing verification tests and reports, and commissioning tests and reports shall be completed and approved by the Program Construction Manager prior to Substantial Completion.

§ 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 Program Construction Manager, and the Contractor and Program Construction Manager shall jointly prepare a "Punch List," which is defined as 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.

§ 9.8.2.1 The period to complete the items on the Punch List, created with and attached to the Certificate of Substantial Completion, shall be thirty (30) days from the issuance of the Certificate of Substantial Completion. Within five (5) days of receipt of the Certificate of Substantial Completion, Contractor shall submit a Punch List completion schedule. Items not completed within the thirty (30) day period will be remedied by other sources and the costs deducted from the Contractor's final Application for Payment. These deducted costs will include costs incurred by the Program Construction Manager and Owner associated with rectifying the listed items. All warranties and closeout documentation must be complete, submitted and approved by the Program Construction Manager prior to the Certificate Substantial Completion being released.

§ 9.8.2.2 Division 23 "Temperature Controls Contractor" functional testing/verification documents once submitted as being completed, will be verified by the commissioning agent. If the commissioning agent finds the work incomplete, they will stop Work and notify the Temperature Control Contractor of the findings. The Temperature Control Contractor will again review and correct any deficiencies before reconducting the commissioning agent for re-verification. Should the commissioning agent find the Work is still incomplete the Temperature Controls Contractor shall bear all costs of the commissioning agent thereafter as described in Section 9.8.2.1.

§ 9.8.3 The Program Construction Manager will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Program Construction Manager's inspection discloses any item that 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 Program Construction Manager. In such case, the Contractor shall then submit a request for another inspection by the Program Construction Manager to determine Substantial Completion.

§ 9.8.4 When the Program Construction Manager determines that the Work of all of the Contractors, or designated portion thereof, is substantially complete, the Program Construction Manager will prepare and 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 Punch List accompanying the Certificate.

§ 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 Program Construction Manager shall jointly prepare a Punch List 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 Program Construction Manager.

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

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Program Construction Manager a notice that the Work is ready for final inspection and acceptance, and in triplicate the following documents: (1) a final Contractor's Application for Payment; (2) Contractor's Affidavit of Payment of Debts and Claims (AIA Document G706); (3) Contractor's lien waiver in the full amount of the Contract Sum; (4) lien waivers from all Subcontractors and Sub-subcontractors that furnished material or Work on the Project in the full amount of the subcontract sum or sub-subcontract sum; (5) consent of surety to final payment (AIA Document G707); and (6) final record documents on clean plans. Upon receipt, the Program Construction Manager shall perform an inspection to confirm the completion of Work of the Contractor. 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.

§ 9.10.2 When the Program Construction Manager finds the Work acceptable under the Contract Documents and the Contract fully performed, the Program Construction Manager will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of its knowledge, information and belief, and on the basis of its 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 Program Construction Manager's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.3 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.3 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Program 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, and (4) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties.

§ 9.10.4 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 Program Construction Manager so confirms, the Owner shall, upon application by the Contractor and certification by the Program Construction Manager, 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 Program 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.

§ 9.10.5 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.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

§ 10.1.1 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 Program Construction Manager for review and coordination with the safety programs of other Contractors. The Program 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 Program Construction Manager.

§ 10.1.2 Contractor is responsible to provide an overview of its safety program, including a policy statement, description of its methods of implementing and enforcing safety measures, and its procedures for identifying/controlling hazards.

§ 10.1.3 Prior to the first Application for Payment, Contractor shall provide: (1) a written inventory of all hazardous materials on the Project site; (2) a material safety data sheet (MSDS) for each of the hazardous materials; and (3) a statement on Contractor's letterhead confirming that its employees, agents, or others performing Work with the hazardous materials have received proper training in the handling of those hazardous materials.

§ 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 or Program Construction 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 and Program Construction Manager.

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 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 and Program Construction Manager of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Program Construction Manager the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and Program Construction Manager 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 or Program Construction Manager has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Program Construction Manager have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Program Construction Manager, their consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of

tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance the following types and limits of insurance from a company or companies lawfully authorized to issue insurance in the jurisdiction where the Project is located and the insurance carrier is rated by AM Best at A- VII or better, to protect the Contractor from Claims that may arise out of, or result from, the Contractor's operations and completed operations under the Contract:

Type of Insurance	**Limits**	**Other Pertinent Requirements**
Commercial General Liability	\$1,000,000 Each Occurrence \$2,000,000 General Aggregate \$1,000,000 Personal and Advertising Injury \$2,000,000 Products-Completed Operations Aggregate \$100,000 Fire Damage Limit \$5,000 Medical Payment	The Policy shall be endorsed to have the General Aggregate apply to this Project only. No modification to the definition of insured contract as outlined in a typical ISO policy form. Products and Completed Operations insurance shall be maintained for a minimum of one (1) year after the expiration of the period for correction of Work. No specific exclusions for independent contractors, collapse, underground, explosion or subsidence, action over claims, and punitive damages. See section 11.1.5 for Additional Insured Requirements.
Automotive Liability	\$1,000,000 bodily injury and property damage	Automotive Liability insurance must include non-owned and hired liability.
Employer's Liability	\$1,000,000 per accident, disease—policy limit, and disease—per employee	
Worker's Compensation	As required by the State where the Project is located.	

Excess/Umbrella	$5,000,000 per occurrence and aggregate	
Pollution Liability	$1,000,000 per occurrence; no hazardous materials	
Drone Liability	$2,000,000	Not required if Contractor will not operate a drone device in conjunction with the work or at any Premises.

§ 11.1.2 Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Contractor's Work until the date of final payment and termination of any coverage required to be maintained after final payment to the Contractor, and, with respect to the Contractor's completed operations coverage until the expiration of the period for correction of Work.

§ 11.1.3 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner and Program Construction Manager evidencing compliance with the requirements of this Article 11 at the following times: (1) prior to commencement of the Contractor's Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the written request of the Owner or Program Construction Manager. An additional certificate evidencing continuation of 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 time required in this Article 11. The certificates of insurance shall list the Owner, Program Construction Manager, and the Program Construction Manager's consultants as additional insureds on the Contractor's Commercial General Liability insurance.

§ 11.1.4 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.

§ 11.1.5 Additional Insured Obligations. Additional insured endorsements CG 2010 0704 and CG 2037 0704 or equivalent required. The Owner and Program Construction Manager shall be listed as the additional insured parties on Contractor's commercial general liability insurance. The additional insured coverage shall be primary and non-contributory to any of the general liability insurance policies of the Owner and Program Construction Manager and shall apply to both ongoing and completed operations.

§ 11.1.6 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 Program 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.

§ 11.2 Owner's Insurance

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

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform both the Contractor and the Program Construction Manager, separately and in writing, prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of

the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

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

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Program Construction Manager and Program Construction Manager's consultants; (3) other Contractors and any of their subcontractors, sub-subcontractors, agents, and employees; and (4) 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 Program Construction Manager, Program Construction Manager'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. The Owner waives all rights of action against the Contractor and Program Construction Manager for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Program Construction Manager and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Program Construction Manager 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 fourteen (14) days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not

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

§ 11.6 Surety Bonds

§ 11.6.1 The Contractor shall provide performance and payment bonds in the full value of the Contractor's contract, 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.

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

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 Program Construction Manager'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 Program Construction Manager has not specifically requested to examine prior to its being covered, the Program Construction Manager 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 Program Construction Manager 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 Program Construction Manager'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 (1) year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special Warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of Warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Program Construction Manager, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one (1) 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 (1) 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 (1) year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the State where the Project is located.

§ 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, Program Construction Manager, 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 Program Construction Manager timely notice of when and where tests and inspections are to be made so that the Program Construction Manager 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 Program Construction Manager, 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 Program Construction Manager 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 Program Construction Manager of when and where tests and inspections are to be made so that the Program Construction Manager 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 Program Construction Manager'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 Program Construction Manager.

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

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

§ 13.5 Interest

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

§ 13.6 Equal Opportunity

Pursuant to Executive Order 11246, as amended, the Rehabilitation Act of 1973, as amended, and the Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, Contractor is advised that under the provisions of government contracting and in accordance with these laws, Contractors and Subcontractors are obliged to take affirmative action to provide equal employment opportunity without regard to race, color, religion, national origin, age, sex, physical, or mental disability, or status as a special disabled veteran or veteran of the Vietnam era.

§ 13.7 Out of State Contractor

Contractor represents and warrants that it shall be responsible for payment of all taxes, including but not limited to income, sales, and use taxes applicable to its Work and the Work of Contractor's Subcontractors. Contractors shall indemnify and hold Owner harmless from all damages, claims, fines, penalties, and demands, including reasonable attorney's fees, arising from or in any way connected with any breach of these representations and warranties by Contractor.

§ 13.8 Assignment/Subcontracts

No assignments by Contractor or Subcontractor of subcontract or of any amounts due or to become due under this Contract shall be binding upon the Owner or Program Construction Manager until Contractor's written consent is obtained, in which event this Contract shall be binding upon and inure to the benefit of the parties hereto and not further subcontract portions of this Contract without the Owner's and Program Construction Manager's prior approval.

§ 13.9 Attorney's Fees and Costs

Should either party employ an attorney to initiate a lawsuit or demand arbitration to enforce any of the provisions hereto to protect its interests in any manner arising under this Contract, or to recover on a surety bond furnished by a party to this Contract, the prevailing party shall be entitled to recover reasonable attorney's fees, costs, charges, and expenses.

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 thirty (30) consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Program Construction Manager has not certified or 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; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' notice to the Owner and Program Construction Manager, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of sixty (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 (7) additional days' notice to the Owner and Program Construction Manager, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, after consultation with and certification by the Program Construction Manager that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, forty-eight (48) hour notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Program Construction Manager's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker. The obligations for payment pursuant to this Section 14.2 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.

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated

within twenty-one (21) days after occurrence of the event giving rise to such Claim or within twenty-one (21) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost.

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

§ 15.1.5.2 No claim by Subcontractor for any extra compensation is enforceable against Contractor unless Subcontractor's claim is based on a Change Order, issued by Contractor pursuant to Article 7, that has been fully performed by Subcontractor in accordance with its terms. Contractor shall pay for extra Work arising from changes required by Owner upon the same terms and conditions as set forth in the Contract Documents, but only to the extent that Contract is paid for the extra Work.

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Subcontractor Claims

§ 15.1.7.1 For subcontractor to make a claim under Sections 15.1.5 and 15.1.6, Subcontractor must submit the Claim to the Contractor. Within twenty-four (24) hours of receipt of a Claim from Subcontractor, shall notify and provide a copy of the Claim to the Owner and Program Construction Manager of the Claim.

§ 15.1.7.2 For Within fourteen (14) days of the submission Subcontractor's Claim, Contractor shall either:

- **.1** submit a notice of Claim and Claim to the Owner and Program Construction Manager based solely upon the Subcontractor's Claim;
- **.2** submit a notice of Claim and Claim to the Owner and Program Construction Manager based upon the Subcontractor's Claim and any other related Claims the Contractor may possess at the current time; or
- **.3** submit a notice to the Subcontractor, Owner, and Program Construction Manager rejecting Subcontractor's Claim in its entirety, including Contractor's rationale for such a rejection.

§ 15.1.7.3 Upon submission of a Claim pursuant to Sections 15.1.7.2.1 and 15.1.7.2.2, the Claims process shall proceed consistent with this Article 15 as if the Claim were submitted from the Contractor. Contractor shall provide all correspondence between it and the Initial Decision Maker to the Subcontractor related to the Claim within twenty-four (24) hours of Contractor's receipt of the same.

§ 15.1.7.4 Contractor shall provide a copy of its notice of Claim and Claim to Subcontractor when acting pursuant to Sections 15.1.7.2.1 and 15.1.7.2.2.

§ 15.1.8 Waiver of Claims for Consequential Damages. Notwithstanding any provision in the Contract Documents, Contractor waives Claims against the Owner and Program Construction Manager for consequential, incidental, indirect, punitive, and special damages arising out of or relating to this Contract. This waiver includes:

.1 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 completion of the Work.

Nothing contained in this Section 15.1.8 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 Program Construction Manager 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 thirty (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 (10) days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

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

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten (10) 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 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 thirty (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 thirty (30) days of receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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

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

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.8, shall be subject to mediation as a condition precedent to binding dispute resolution.

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

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

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

END OF SECTION 007200

DRAFT

AIA® Document A132™ – 2019

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

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month, and year.)

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

«Clinton Graceville Beardsley District 2888»« »
«601 1st Street »
«Graceville, MN 56240 »
« »

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

«SAMPLE »« »
« »
« »
« »

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

«Clinton-Graceville Beardsley Schools, Phase I addition »
«712 East 3rd Street »
«Graceville, MN 56240 »

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

«SitelogIQ, Inc. »« »
«7900 W 7th St. Suite 400»
«Edina, MN 55439»
« »

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

«DesignArc Group »« »
«434 5th Street, Suite 1»
«Brookings, SD 57006»
« »

The Owner and Contractor agree as follows.

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

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

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

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9. The definitions for the capitalized terms utilized in this Agreement are found in AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition.

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.

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

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

« »

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

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

§ 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
« Phase 1 Gym Locker Rooms, Multipurpose and Wellness Addition: »	February 20, 2026
Phase 1* Pre-K Addition	July 22, 2026
Phase 2	December 26, 2025
Phase 3	August 22, 2025
Phase 4	August 21, 2026
Phase 5	August 21, 2026

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

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

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

[« X »] By the following date: « SAMPLE »

§ 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 « SAMPLE » ($ « SAMPLE »), 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:

Item	Price
« »	

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

Item	Price	Conditions for Acceptance
« »		

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

Item	Price
« »	

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

Item	Units and Limitations	Price per Unit ($0.00)
« »		

§ 4.3 Cost of the Work Plus Contractor's Fee without a Guaranteed Maximum Price
§ 4.3.1 The Cost of the Work is as defined in Exhibit B, Determination of the Cost of the Work.

§ 4.3.2 The Contractor's Fee:
(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)

« »

§ 4.3.3 The method of adjustment of the Contractor's Fee for changes in the Work:

« »

§ 4.3.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

« »

§ 4.3.5 Rental rates for Contractor-owned equipment shall not exceed « » percent (« » %) of the standard rental rate paid at the place of the Project.

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

Item	Units and Limitations	Price per Unit ($0.00)
« »		

§ 4.3.7 The Contractor shall prepare and submit to the Program Construction Manager, within 14 days of executing this Agreement, a written Control Estimate for the Owner's review and approval. The Control Estimate shall include the items in Section B.1 of Exhibit B, Determination of the Cost of the Work.

§ 4.4 Cost of the Work Plus Contractor's Fee with a Guaranteed Maximum Price
§ 4.4.1 The Cost of the Work is as defined in Exhibit B, Determination of the Cost of the Work.

§ 4.4.2 The Contractor's Fee:
(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)

« »

§ 4.4.3 The method of adjustment of the Contractor's Fee for changes in the Work:

« »

§ 4.4.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

« »

§ 4.4.5 Rental rates for Contractor-owned equipment shall not exceed « » percent (« » %) of the standard rental rate paid at the place of the Project.

§ 4.4.6 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)
« »		

§ 4.4.7 Guaranteed Maximum Price

§ 4.4.7.1 The Contract Sum is guaranteed by the Contractor not to exceed « » ($ « »), subject to additions and deductions by Change Order as provided in the Contract Documents. This maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner.

§ 4.4.7.2 Alternates

§ 4.4.7.2.1 Alternates, if any, included in the Guaranteed Maximum Price:

Item	Price
« »	

§ 4.4.7.2.2 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
« »		

§ 4.4.7.3 Allowances, if any, included in the Guaranteed Maximum Price:
(Identify each allowance.)

Item	Price
« »	

§ 4.4.7.4 Assumptions, if any, upon which the Guaranteed Maximum Price is based:
(Identify each assumption.)

« »

§ 4.4.8 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes, or equipment, all of which, if required, shall be incorporated by Change Order.

§ 4.4.9 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in Section 4.4.7.4. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions contained in Section 4.4.7.4 and the revised Contract Documents.

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any, to be assessed in accordance with Section 3.4.)

« »

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

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Program Construction Manager by the Contractor, and Certificates for Payment issued by the Program 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 Program Construction Manager not later than the « 1st » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « last » day of the « same » month. If an Application for Payment is received by the Program Construction Manager after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « thirty » (« 30 ») days after the Program 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 Program Construction Manager and Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.4.2 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

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

§ 5.1.5 Progress Payments Where the Contract Sum is Based on the Cost of the Work without a Guaranteed Maximum Price

§ 5.1.5.1 With each Application for Payment, the Contractor shall submit the cost control information required in Exhibit B, Determination of the Cost of the Work, along with payrolls, petty cash accounts, receipted invoices, or invoices with check vouchers attached, and any other evidence required by the Owner, Program Construction Manager or Architect to demonstrate that payments already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor, plus payrolls for the period covered by the present Application for Payment, less that portion of the payments attributable to the Contractor's Fee.

§ 5.1.5.2 Applications for Payment shall show the Cost of the Work actually incurred by the Contractor through the end of the period covered by the Application for Payment and for which the Contractor has made or intends to make actual payment prior to the next Application for Payment.

§ 5.1.5.3 In accordance with AIA Document A232-2019 and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

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

.1 The Cost of the Work as described in Exhibit B, Determination of the Cost of the Work;

.2 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified; and

.3 The Contractor's Fee computed upon the Cost of the Work described in the preceding Section 5.1.5.3.1.1 at the rate stated in Section 4.3.2; or if the Contractor's Fee is stated as a fixed sum in Section 4.3.2 an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work included in Section 5.1.5.3.1.1 bears to a reasonable estimate of the probable Cost of the Work upon its completion.

§ 5.1.5.3.2 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;

.5 The shortfall, if any, indicated by the Contractor in the documentation required by Section 5.1.5.1 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and

.6 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.5.4 The Owner, Program Construction Manager and Contractor shall agree upon a mutually acceptable procedure for review and approval of payments to Subcontractors and the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

§ 5.1.5.5 In taking action on the Contractor's Applications for Payment, the Program Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor, and such action shall not be deemed to be a representation that (1) the Program Construction Manager and Architect have made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Article 5 or other supporting data; (2) that the Program Construction Manager and Architect have made exhaustive or continuous on-site inspections; or (3) that the Program Construction Manager and Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 5.1.5.6 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.5.7 If final completion of the Work is materially delayed through no fault of the Contractor, then the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A232-2019.

§ 5.1.6 Progress Payments Where the Contract Sum is Based on the Cost of the Work with a Guaranteed Maximum Price

§ 5.1.6.1 With each Application for Payment, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner, Program Construction Manager or Architect to demonstrate that payments already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Contractor's Fee.

§ 5.1.6.2 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 Guaranteed Maximum Price among: (1) the various portions of the Work; (2) any contingency for costs that are included in the Guaranteed Maximum Price but not otherwise allocated to another line item or included in a Change Order; and (3) the Contractor's Fee.

§ 5.1.6.2.1 The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Program Construction Manager and Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.6.2.2 The allocation of the Guaranteed Maximum Price under this Section 5.1.6.2 shall not constitute a separate guaranteed maximum price for the Cost of the Work of each individual line item in the schedule of values.

§ 5.1.6.2.3 When the Contractor allocates costs from a contingency to another line item in the schedule of values, the Contractor shall submit supporting documentation to the Architect and Program Construction Manager.

§ 5.1.6.3 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. The percentage of completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed; or (2) the percentage obtained by dividing (a) the expense that has actually been incurred by the Contractor on account of that portion of the Work and for which the Contractor has made payment or intends to make payment prior to the next Application for Payment by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

§ 5.1.6.4 In accordance with AIA Document A232-2019, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

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

.1 That portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage of completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the most recent schedule of values;

.2 That portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction or, if approved in writing in advance by the Owner, suitably stored off the site at a location agreed upon in writing;

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified; and

.4 The Contractor's Fee, computed upon the Cost of the Work described in the preceding Sections 5.1.6.4.1.1 and 5.1.6.4.1.2 at the rate stated in Section 4.4.2 or, if the Contractor's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum fee as the Cost of the Work included in Sections 5.1.6.4.1.1 and 5.1.6.4.1.2 bears to a reasonable estimate of the probable Cost of the Work upon its completion.

§ 5.1.6.4.2 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;
.5 The shortfall, if any, indicated by the Contractor in the documentation required by Section 5.1.6.1 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and
.6 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.6.5 The Owner and the Contractor shall agree upon a mutually acceptable procedure for review and approval of payments to Subcontractors and the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

§ 5.1.6.6 In taking action on the Contractor's Applications for Payment, the Program Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor and such action shall not be deemed to be a representation that (1) the Program Construction Manager or Architect have made a detailed examination, audit, or arithmetic verification of the documentation submitted in accordance with Section 5.1.6.1 or other supporting data; (2) that the Program Construction Manager or Architect have made exhaustive or continuous on-site inspections; or (3) that the Program Construction Manager or Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits, and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 5.1.6.7 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.6.8 If final completion of the Work is materially delayed through no fault of the Contractor, then the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A232-2019.

§ 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.)

« »

§ 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 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; and

.2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect.

§ 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:

« »

§ 5.2.2 Final Payment Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

§ 5.2.2.1 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 the Contractor has submitted a final accounting for the Cost of the Work, pursuant to Exhibit B, Determination of the Cost of the Work and a final Application for Payment; and

.3 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect in accordance with Exhibit B, Determination of the Cost of the Work.

§ 5.2.2.2 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 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.)

«1.5» % «The Contractor shall pay any Subcontractor within ten (10) days of the Contractor's receipt of payment from the Owner for undisputed services provided by the Subcontractor. »

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.
(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)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

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.

§ 7.1.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A232–2019, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« None »

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

§ 7.2 Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

§ 7.2.1 Termination

§ 7.2.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019.

§ 7.2.1.2 Termination by the Owner for Cause

§ 7.2.1.2.1 If the Owner terminates the Contract for cause as provided in Article 14 of AIA Document A232–2019, the Owner shall then only pay the Contractor an amount as follows:

.1 Take the Cost of the Work incurred by the Contractor to the date of termination;

.2 Add the Contractor's Fee, computed upon the Cost of the Work to the date of termination at the rate stated in Section 4.3.2 or 4.4.2, as applicable, or, if the Contractor's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion;

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract the costs and damages incurred, or to be incurred, by the Owner under Article 14 of AIA Document A232–2019.

§ 7.2.1.2.2 When the Contract Sum is based on the Cost of the Work with a Guaranteed Maximum Price, if the Owner terminates the Contract for cause as provided in Article 14 of AIA Document A232-2019, the amount, if any, to be paid to the Contractor under Article 14 of AIA Document A232-2019 shall not cause the Guaranteed Maximum Price to be exceeded, nor shall it exceed the amount calculated in Section 7.2.1.2.1.

§ 7.2.1.2.3 The Owner shall also pay the Contractor fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Contractor that the Owner elects to retain and that is not otherwise included in the Cost of the Work under Section 7.2.1.2.1.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Contractor shall, as a condition of receiving the payments referred to in this Article 7, execute and deliver all such papers and take all such steps, including the legal

assignment of such subcontracts and other contractual rights of the Contractor, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Contractor under such subcontracts or purchase orders. All Subcontracts, purchase orders and rental agreements entered into by the Contractor will contain provisions allowing for assignment to the Owner as described above.

§ 7.2.1.3 Termination by the Owner for Convenience

If the Owner terminates the Contract for convenience in accordance with Article 14 of AIA Document A232–2019, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of or method for determining the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« »

§ 7.3 Suspension

The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019; 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)

« Brad Kelvington»
« Clinton Graceville Beardsley District 2888 »
« 712 East 3rd Streett »
« Graceville, MN 56240 »
« cc: SitelogIQ, Inc. – darin.klein@sitelogiq.com and legal@sitelogiq.com »
« »

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

«SAMPLE »
« »
« »
« »
« »
« »

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

§ 8.5 Insurance and Bonds

The Contractor shall purchase and maintain insurance as set forth in Article 11 of AIA Document A232-2019. The Contractor shall provide performance and payment bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, to cover the full Contract Sum indicated in Section 4.2 of this Agreement.

§ 8.6 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor's Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all

times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

§ 8.7 Other provisions:

« »

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 A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition as found in specification section 007200.

.3 Drawings

Number	Title	Date
« »		

.4 Specifications

Section	Title	Date	Pages
« »			

.5 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.

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

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

END OF SECTION 007210

MINNESOTA DEPARTMENT OF LABOR AND INDUSTRY PREVAILING WAGES FOR STATE FUNDED CONSTRUCTION PROJECTS

THIS NOTICE MUST BE POSTED ON THE JOBSITE IN A CONSPICUOUS PLACE

Construction Type: Commercial

County Number: 06

County Name: BIG STONE

Effective: 2023-12-26

This project is covered by Minnesota prevailing wage statutes. Wage rates listed below are the minimum hourly rates to be paid on this project.

All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at a rate of one and one half (1 1/2) times the basic hourly rate. *Note: Overtime pay after eight (8) hours on the project must be paid even if the worker does not exceed forty (40) hours in the work week.*

Violations should be reported to:

Department of Labor and Industry
Prevailing Wage Section
443 Lafayette Road N
St Paul, MN 55155
(651) 284-5091
DLI.PrevWage@state.mn.us

* Indicates that adjacent county rates were used for the labor class listed.

County: BIG STONE (06)

LABOR CODE AND CLASS			EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
LABORERS (101 - 112) (SPECIAL CRAFTS 701 - 730)						
101*	LABORER, COMMON (GENERAL LABOR WORK)		2023-12-26	34.38	23.42	57.80
			2024-05-01	36.06	23.97	60.03
102*	LABORER, SKILLED (ASSISTING SKILLED CRAFT JOURNEYMAN)		2023-12-26	34.38	23.42	57.80
			2024-05-01	36.06	23.97	60.03
103*	LABORER, LANDSCAPING (GARDENER, SOD LAYER AND NURSERY OPERATOR)		2023-12-26	17.50	0.00	17.50
104	FLAG PERSON	+$950,000	2023-12-26	26.51	17.69	44.20
		-$950,000	2023-12-26	24.76	17.69	42.45
105	WATCH PERSON	+$950,000	2023-12-26	24.53	17.69	42.22

LABOR CODE AND CLASS			EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
		-$950,000	2023-12-26	22.78	17.69	40.47
106	BLASTER	+$950,000	2023-12-26	27.51	17.69	45.20
		-$950,000	2023-12-26	25.76	17.69	43.45
107*	PIPELAYER (WATER, SEWER AND GAS)		2023-12-26	15.00	0.00	15.00
108	TUNNEL MINER		FOR RATE CALL 651-284-5091 OR EMAIL DLI.PREVWAGE@STATE.MN.US			
109	UNDERGROUND AND OPEN DITCH LABORER (EIGHT FEET BELOW STARTING GRADE LEVEL)		2023-12-26	22.09	14.90	36.99
110*	SURVEY FIELD TECHNICIAN (OPERATE TOTAL STATION, GPS RECEIVER, LEVEL, ROD OR RANGE POLES, STEEL TAPE MEASUREMENT; MARK AND DRIVE STAKES; HAND OR POWER DIGGING FOR AND IDENTIFICATION OF MARKERS OR MONUMENTS; PERFORM AND CHECK CALCULATIONS; REVIEW AND UNDERSTAND CONSTRUCTION PLANS AND LAND SURVEY MATERIALS). THIS CLASSIFICATION DOES NOT APPLY TO THE WORK PERFORMED ON A PREVAILING WAGE PROJECT BY A LAND SURVEYOR WHO IS LICENSED PURSUANT TO MINNESOTA STATUTES, SECTIONS 326.02 TO 326.15.	+$950,000	2023-12-26	26.51	17.69	44.20
		-$950,000	2023-12-26	24.76	17.69	42.45
111	TRAFFIC CONTROL PERSON (TEMPORARY SIGNAGE)		FOR RATE CALL 651-284-5091 OR EMAIL DLI.PREVWAGE@STATE.MN.US			
SPECIAL EQUIPMENT (201 - 204)						
201*	ARTICULATED HAULER		2023-12-26	17.50	0.00	17.50
202*	BOOM TRUCK		FOR RATE CALL 651-284-5091 OR EMAIL DLI.PREVWAGE@STATE.MN.US			
203	LANDSCAPING EQUIPMENT, INCLUDES HYDRO SEEDER OR MULCHER, SOD ROLLER, FARM		2023-12-26	11.00	0.00	11.00

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
	TRACTOR WITH ATTACHMENT SPECIFICALLY SEEDING, SODDING, OR PLANT, AND TWO-FRAMED FORKLIFT (EXCLUDING FRONT, POSIT-TRACK, AND SKID STEER LOADERS), NO EARTHWORK OR GRADING FOR ELEVATIONS				
204*	OFF-ROAD TRUCK	FOR RATE CALL 651-284-5091 OR EMAIL DLI.PREVWAGE@STATE.MN.US			
205	PAVEMENT MARKING OR MARKING REMOVAL EQUIPMENT (ONE OR TWO PERSON OPERATORS); SELF-PROPELLED TRUCK OR TRAILER MOUNTED UNITS.	2023-12-26	14.24	0.76	15.00
HIGHWAY/HEAVY POWER EQUIPMENT OPERATOR					
GROUP 2 *		2023-12-26	40.00	0.00	40.00
306	GRADER OR MOTOR PATROL				
308	TUGBOAT 100 H.P. AND OVER WHEN LICENSE REQUIRED (HIGHWAY AND HEAVY ONLY)				
GROUP 3 *		2023-12-26	36.50	0.00	36.50
309	ASPHALT BITUMINOUS STABILIZER PLANT				
310	CABLEWAY				
312	DERRICK (GUY OR STIFFLEG)(POWER)(SKIDS OR STATIONARY) (HIGHWAY AND HEAVY ONLY)				
314	DREDGE OR ENGINEERS, DREDGE (POWER) AND ENGINEER				
316	LOCOMOTIVE CRANE OPERATOR				
320	TANDEM SCRAPER				
322	TUGBOAT 100 H.P AND OVER (HIGHWAY AND HEAVY ONLY)				
GROUP 4 *		2023-12-26	35.00	0.00	35.00
323	AIR TRACK ROCK DRILL				
324	AUTOMATIC ROAD MACHINE (CMI OR SIMILAR) (HIGHWAY AND HEAVY ONLY)				
325	BACKFILLER OPERATOR				
327	BITUMINOUS ROLLERS, RUBBER TIRED OR STEEL DRUMMED (EIGHT TONS AND OVER)				
328	BITUMINOUS SPREADER AND FINISHING MACHINES (POWER), INCLUDING PAVERS, MACRO SURFACING AND MICRO SURFACING, OR SIMILAR TYPES (OPERATOR AND SCREED PERSON)				
329	BROKK OR R.T.C. REMOTE CONTROL OR SIMILAR TYPE WITH ALL ATTACHMENTS				
330	CAT CHALLENGER TRACTORS OR SIMILAR TYPES PULLING ROCK WAGONS, BULLDOZERS AND SCRAPERS				

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
331	CHIP HARVESTER AND TREE CUTTER				
332	CONCRETE DISTRIBUTOR AND SPREADER FINISHING MACHINE, LONGITUDINAL FLOAT, JOINT MACHINE, AND SPRAY MACHINE				
334	CONCRETE MOBIL (HIGHWAY AND HEAVY ONLY)				
335	CRUSHING PLANT (GRAVEL AND STONE) OR GRAVEL WASHING, CRUSHING AND SCREENING PLANT				
336	CURB MACHINE				
337	DIRECTIONAL BORING MACHINE				
338	DOPE MACHINE (PIPELINE)				
340	DUAL TRACTOR				
341	ELEVATING GRADER				
345	GPS REMOTE OPERATING OF EQUIPMENT				
347	HYDRAULIC TREE PLANTER				
348	LAUNCHER PERSON (TANKER PERSON OR PILOT LICENSE)				
349	LOCOMOTIVE (HIGHWAY AND HEAVY ONLY)				
350	MILLING, GRINDING, PLANNING, FINE GRADE, OR TRIMMER MACHINE				
352	PAVEMENT BREAKER OR TAMPING MACHINE (POWER DRIVEN) MIGHTY MITE OR SIMILAR TYPE				
354	PIPELINE WRAPPING, CLEANING OR BENDING MACHINE				
356	POWER ACTUATED HORIZONTAL BORING MACHINE, OVER SIX INCHES				
357	PUGMILL				
359	RUBBER-TIRED FARM TRACTOR WITH BACKHOE INCLUDING ATTACHMENTS (HIGHWAY AND HEAVY ONLY)				
360	SCRAPER				
361	SELF-PROPELLED SOIL STABILIZER				
362	SLIP FORM (POWER DRIVEN) (PAVING)				
363	TIE TAMPER AND BALLAST MACHINE				
365	TRACTOR, WHEEL TYPE, OVER 50 H.P. WITH PTO UNRELATED TO LANDSCAPING (HIGHWAY AND HEAVY ONLY)				
367	TUB GRINDER, MORBARK, OR SIMILAR TYPE				
GROUP 5 *		2023-12-26	31.50	0.00	31.50
370	BITUMINOUS ROLLER (UNDER EIGHT TONS)				
371	CONCRETE SAW (MULTIPLE BLADE) (POWER OPERATED)				
372	FORM TRENCH DIGGER (POWER)				
375	HYDRAULIC LOG SPLITTER				
376	LOADER (BARBER GREENE OR SIMILAR TYPE)				
377	POST HOLE DRIVING MACHINE/POST HOLE AUGER				
379	POWER ACTUATED JACK				
381	SELF-PROPELLED CHIP SPREADER (FLAHERTY OR SIMILAR)				
382	SHEEP FOOT COMPACTOR WITH BLADE . 200 H.P. AND OVER				
383	SHOULDERING MACHINE (POWER) APSCO OR SIMILAR TYPE INCLUDING SELF-PROPELLED SAND AND CHIP SPREADER				

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
384	STUMP CHIPPER AND TREE CHIPPER				
385	TREE FARMER (MACHINE)				
GROUP 6 *		2023-12-26	23.00	19.70	42.70
387	CAT, CHALLENGER, OR SIMILAR TYPE OF TRACTORS, WHEN PULLING DISK OR ROLLER				
389	DREDGE DECK HAND				
391	GRAVEL SCREENING PLANT (PORTABLE NOT CRUSHING OR WASHING)				
393	LEVER PERSON				
395	POWER SWEEPER				
396	SHEEP FOOT ROLLER AND ROLLERS ON GRAVEL COMPACTION, INCLUDING VIBRATING ROLLERS				
397	TRACTOR, WHEEL TYPE, OVER 50 H.P., UNRELATED TO LANDSCAPING				
COMMERCIAL POWER EQUIPMENT OPERATOR					
GROUP 1 *		2023-12-26	43.35	22.85	66.20
501	HELICOPTER PILOT (COMMERCIAL CONSTRUCTION ONLY)				
502	TOWER CRANE 250 FEET AND OVER (COMMERCIAL CONSTRUCTION ONLY)				
503	TRUCK CRAWLER CRANE WITH 200 FEET OF BOOM AND OVER, INCLUDING JIB (COMMERCIAL CONSTRUCTION ONLY)				
GROUP 2 *		2023-12-26	46.85	25.20	72.05
		2024-04-29	48.53	26.40	74.93
504	CONCRETE PUMP WITH 50 METERS/164 FEET OF BOOM AND OVER (COMMERCIAL CONSTRUCTION ONLY)				
505	PILE DRIVING WHEN THREE DRUMS IN USE (COMMERCIAL CONSTRUCTION ONLY)				
506	TOWER CRANE 200 FEET AND OVER (COMMERCIAL CONSTRUCTION ONLY)				
507	TRUCK OR CRAWLER CRANE WITH 150 FEET OF BOOM UP TO AND NOT INCLUDING 200 FEET, INCLUDING JIB (COMMERCIAL CONSTRUCTION ONLY)				
GROUP 3 *		2023-12-26	45.40	25.20	70.60
		2024-04-29	47.02	26.40	73.42
508	ALL-TERRAIN VEHICLE CRANES (COMMERCIAL CONSTRUCTION ONLY)				
509	CONCRETE PUMP 32-49 METERS/102-164 FEET (COMMERCIAL CONSTRUCTION ONLY)				
510	DERRICK (GUY & STIFFLEG) (COMMERCIAL CONSTRUCTION ONLY)				
511	STATIONARY TOWER CRANE UP TO 200 FEET				
512	SELF-ERECTING TOWER CRANE 100 FEET AND OVER MEASURED FROM BOOM FOOT PIN (COMMERCIAL CONSTRUCTION ONLY)				
513	TRAVELING TOWER CRANE (COMMERCIAL CONSTRUCTION ONLY)				
514	TRUCK OR CRAWLER CRANE UP TO AND NOT INCLUDING 150 FEET OF BOOM, INCLUDING JIB (COMMERCIAL CONSTRUCTION ONLY)				
GROUP 4 *		2023-12-26	41.38	22.85	64.23

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
515	CRAWLER BACKHOE INCLUDING ATTACHMENTS (COMMERCIAL CONSTRUCTION ONLY)				
516	FIREPERSON, CHIEF BOILER LICENSE (COMMERCIAL CONSTRUCTION ONLY)				
517	HOIST ENGINEER (THREE DRUMS OR MORE) (COMMERCIAL CONSTRUCTION ONLY)				
518	LOCOMOTIVE (COMMERCIAL CONSTRUCTION ONLY)				
519	OVERHEAD CRANE (INSIDE BUILDING PERIMETER) (COMMERCIAL CONSTRUCTION ONLY)				
520	TRACTOR . BOOM TYPE (COMMERCIAL CONSTRUCTION ONLY)				
GROUP 5 *		2023-12-26	39.97	22.85	62.82
521	AIR COMPRESSOR 450 CFM OR OVER (TWO OR MORE MACHINES) (COMMERCIAL CONSTRUCTION ONLY)				
522	CONCRETE MIXER (COMMERCIAL CONSTRUCTION ONLY)				
523	CONCRETE PUMP UP TO 31 METERS/101 FEET OF BOOM				
524	DRILL RIGS, HEAVY ROTARY OR CHURN OR CABLE DRILL WHEN USED FOR CAISSON FOR ELEVATOR OR BUILDING CONSTRUCTION (COMMERCIAL CONSTRUCTION ONLY)				
525	FORKLIFT (COMMERCIAL CONSTRUCTION ONLY)				
526	FRONT END, SKID STEER 1 C YD AND OVER				
527	HOIST ENGINEER (ONE OR TWO DRUMS) (COMMERCIAL CONSTRUCTION ONLY)				
528	MECHANIC-WELDER (ON POWER EQUIPMENT) (COMMERCIAL CONSTRUCTION ONLY)				
529	POWER PLANT (100 KW AND OVER OR MULTIPLES EQUAL TO 100KW AND OVER) (COMMERCIAL CONSTRUCTION ONLY)				
530	PUMP OPERATOR AND/OR CONVEYOR (TWO OR MORE MACHINES) (COMMERCIAL CONSTRUCTION ONLY)				
531	SELF-ERECTING TOWER CRANE UNDER 100 FEET MEASURED FROM BOOM FOOT PIN (COMMERCIAL CONSTRUCTION ONLY)				
532	STRADDLE CARRIER (COMMERCIAL CONSTRUCTION ONLY)				
533	TRACTOR OVER D2 (COMMERCIAL CONSTRUCTION ONLY)				
534	WELL POINT PUMP (COMMERCIAL CONSTRUCTION ONLY)				
GROUP 6 *		2023-12-26	21.00	6.55	27.55
535	CONCRETE BATCH PLANT (COMMERCIAL CONSTRUCTION ONLY)				
536	FIREPERSON, FIRST CLASS BOILER LICENSE (COMMERCIAL CONSTRUCTION ONLY)				
537	FRONT END, SKID STEER UP TO 1 C YD				
538	GUNITE MACHINE (COMMERCIAL CONSTRUCTION ONLY)				
539	TRACTOR OPERATOR D2 OR SIMILAR SIZE (COMMERCIAL CONSTRUCTION ONLY)				
540	TRENCHING MACHINE (SEWER, WATER, GAS) EXCLUDES WALK BEHIND TRENCHER				
GROUP 7 *		2023-12-26	40.31	25.20	65.51
		2024-04-29	41.73	26.40	68.13
541	AIR COMPRESSOR 600 CFM OR OVER (COMMERCIAL CONSTRUCTION ONLY)				
542	BRAKEPERSON (COMMERCIAL CONSTRUCTION ONLY)				
543	CONCRETE PUMP/PUMPCRETE OR COMPLACO TYPE (COMMERCIAL CONSTRUCTION ONLY)				
544					

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
	FIREPERSON, TEMPORARY HEAT SECOND CLASS BOILER LICENSE (COMMERCIAL CONSTRUCTION ONLY)				
545	OILER (POWER SHOVEL, CRANE, TRUCK CRANE, DRAGLINE, CRUSHERS AND MILLING MACHINES, OR OTHER SIMILAR POWER EQUIPMENT) (COMMERCIAL CONSTRUCTION ONLY)				
546	PICK UP SWEEPER (ONE CUBIC YARD HOPPER CAPACITY) (COMMERCIAL CONSTRUCTION ONLY)				
547	PUMP AND/OR CONVEYOR (COMMERCIAL CONSTRUCTION ONLY)				
GROUP 8 *		2023-12-26	30.90	19.45	50.35
548	ELEVATOR OPERATOR (COMMERCIAL CONSTRUCTION ONLY)				
549	GREASER (COMMERCIAL CONSTRUCTION ONLY)				
550	MECHANICAL SPACE HEATER (TEMPORARY HEAT NO BOILER LICENSE REQUIRED) (COMMERCIAL CONSTRUCTION ONLY)				
TRUCK DRIVERS					
GROUP 1		2023-12-26	18.00	1.25	19.25
601	MECHANIC . WELDER				
602	TRACTOR TRAILER DRIVER				
603	TRUCK DRIVER (HAULING MACHINERY INCLUDING OPERATION OF HAND AND POWER OPERATED WINCHES)				
GROUP 2 *		2023-12-26	26.00	0.00	26.00
604	FOUR OR MORE AXLE UNIT, STRAIGHT BODY TRUCK				
GROUP 3 *		2023-12-26	23.66	16.20	39.86
605	BITUMINOUS DISTRIBUTOR DRIVER				
606	BITUMINOUS DISTRIBUTOR (ONE PERSON OPERATION)				
607	THREE AXLE UNITS				
GROUP 4 *		2023-12-26	16.00	0.00	16.00
608	BITUMINOUS DISTRIBUTOR SPRAY OPERATOR (REAR AND OILER)				
609	DUMP PERSON				
610	GREASER				
611	PILOT CAR DRIVER				
612	RUBBER-TIRED, SELF-PROPELLED PACKER UNDER 8 TONS				
613	TWO AXLE UNIT				
614	SLURRY OPERATOR				
615	TANK TRUCK HELPER (GAS, OIL, ROAD OIL, AND WATER)				
616	TRACTOR OPERATOR, UNDER 50 H.P.				
SPECIAL CRAFTS					

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
701*	HEATING AND FROST INSULATORS	2023-12-26	49.04	31.70	80.74
702*	BOILERMAKERS	2023-12-26	41.94	29.99	71.93
703*	BRICKLAYERS	2023-12-26	33.97	23.83	57.80
		2024-05-01	38.05	23.83	61.88
704*	CARPENTERS	2023-12-26	33.14	24.69	57.83
705	CARPET LAYERS (LINOLEUM)	2023-12-26	25.44	9.77	35.21
706*	CEMENT MASONS	2023-12-26	18.00	0.18	18.18
707	ELECTRICIANS	2023-12-26	43.67	27.49	71.16
708*	ELEVATOR CONSTRUCTORS	2023-12-26	57.49	43.71	101.20
709*	GLAZIERS	2023-12-26	46.73	25.50	72.23
		2024-06-03	49.73	25.50	75.23
710	LATHERS	FOR RATE CALL 651-284-5091 OR EMAIL DLI.PREVWAGE@STATE.MN.US			
712*	IRONWORKERS	2023-12-26	43.00	34.11	77.11
		2024-04-28	46.00	34.11	80.11
714*	MILLWRIGHT	2023-12-26	34.13	30.28	64.41
715*	PAINTERS (INCLUDING HAND BRUSHED, HAND SPRAYED, AND THE TAPING OF PAVEMENT MARKINGS)	2023-12-26	30.10	23.45	53.55
716*	PILEDRIVER (INCLUDING VIBRATORY DRIVER OR EXTRACTOR FOR PILING AND SHEETING OPERATIONS)	2023-12-26	27.46	16.11	43.57
717	PIPEFITTERS . STEAMFITTERS	2023-12-26	47.24	32.50	79.74
		2024-05-01	50.44	32.50	82.94

LABOR CODE AND CLASS		EFFECT DATE	BASIC RATE	FRINGE RATE	TOTAL RATE
718*	PLASTERERS	2023-12-26	25.47	14.88	40.35
719*	PLUMBERS	2023-12-26	48.29	29.58	77.87
720*	ROOFER	2023-12-26	39.01	21.93	60.94
		2024-06-01	41.81	21.93	63.74
721*	SHEET METAL WORKERS	2023-12-26	39.23	28.57	67.80
		2024-09-02	41.68	28.57	70.25
722*	SPRINKLER FITTERS	2023-12-26	36.33	18.49	54.82
723*	TERRAZZO WORKERS	2023-12-26	37.58	16.83	54.41
724	TILE SETTERS	2023-12-26	30.66	10.53	41.19
725	TILE FINISHERS	FOR RATE CALL 651-284-5091 OR EMAIL DLI.PREVWAGE@STATE.MN.US			
726*	DRYWALL TAPER	2023-12-26	29.97	23.73	53.70
727*	WIRING SYSTEM TECHNICIAN	2023-12-26	44.61	20.16	64.77
728*	WIRING SYSTEMS INSTALLER	2023-12-26	31.25	16.34	47.59
729*	ASBESTOS ABATEMENT WORKER	2023-12-26	37.63	23.36	60.99
		2024-01-01	39.86	24.11	63.97
730	SIGN ERECTOR	2023-12-26	23.69	8.12	31.81

End of wage rates

SECTION 007343 – WAGE RATE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for the following:
      a. Prevailing Wage Rate Requirements.

1.2 PREVAILING WAGE RATE REQUIREMENTS

A. Per the Minnesota Department of Labor and Industry or other statutes, Contractor shall pay laborers of each trade or occupation, performing Work on this Project, not less than the minimum, current Prevailing Wage Rate. Records verifying the issuance of prevailing wages to persons who have Worked or are Working on this Project and their certified payroll statements may be required before payments to Contractor is permitted.

B. Laborers or mechanics employed directly on Project site by Contractor or Subcontractors, agents, or other persons doing or contracting to do all or a part of the Work on the Project, shall not be paid a lesser wage rate than the Prevailing Wage Rates determined for the same or most similar trade or occupation in the Wage Rate Determination Schedule.

C. Contractor and Subcontractors shall submit a "Statement of Intent to Pay Prevailing Wages," as approved by the Department of Labor and Industry, with each Application for Payment and before payments are made.

D. At time of submitting the Intent to Pay Prevailing Wages and the Affidavit of Wages Paid forms, Contractor shall pay associated fees to the appropriate governing authority.

1.3 SELF EMPLOYED SUBCONTRACTOR

A. Should the Contractor or any Subcontractor propose to subcontract any portion of the Work to a self employed Subcontractor of whatever tier; then such written proposal must contain information sufficient for the Owner and the Program Construction Manager to determine to their satisfaction that the proposed self-employed Subcontractor will perform the subcontract Work as a bona fide Independent Contractor. The general standard to determine whether an individual is an independent Contractor or an employee is: If an individual is subject to the control or direction of another merely as to the result to be accomplished by the Work, but not as to the details, means and methods for accomplishing the result, then the individual in an independent Contractor rather than an employee. In making their determination under this standard, The Owner and the Program Construction Manager will apply the factors utilized by the Internal Revenue Service, the Minnesota Department of Revenue and the Minnesota Department of Labor and Industry. In general, those factors require that:
   1. The self-employed Subcontractor establishes, subject to the Project schedule, the pattern, order, sequence, routine and hours of performance of the subcontract Work.
   2. The self-employed Subcontractor performs similar services for others in addition to the other party to the subcontract and under the terms of the subcontract may do so simultaneously with the performance of the subcontract Work.
   3. The self-employed Subcontractor, in performing the subcontract Work, is subject to a real risk of loss due to liability for expenses for (and/or investment in) facilities, tools, materials and/or equipment necessary to perform the subcontract Work.

4. Neither the self-employed Subcontractor or the other party to the subcontract may, without cause, terminate the subcontract without incurring liability for breach of the subcontract.

B. If Independent Contractor status cannot be determined to the satisfaction of the School District by submittal of the required information or documentation, the Independent Contractor status will be disallowed, and the individual(s) will be included on engaging company's payroll as employees, will be entitled to receipt of their prevailing wage for all Work performed.

1.4 PREVAILING WAGE RATE DETERMINATION SCHEDULE

A. The most current copy of the Minnesota Prevailing Wage Determination Schedule for Big Stone County is included at the end of this Document for the Contractor's reference.

1.5 POSTING OF WAGE DETERMINATION SCHEDULES

A. Post and maintain at least one (1) copy of the Prevailing Wage Determination Schedule and the Statement of Intent to Pay Prevailing Wages in a conspicuous location on site until Substantial Completion of Project.

1.6 ENFORCEMENT AND COMPLIANCE

A. The Contractor is not relieved from responsibility for paying prevailing wage rates for trades in question. Additional classifications may develop as determined by the Minnesota Department of Labor and Industry or other statutes. No inferences may be drawn from the omission of a classification that has local usage. Owner and Program Construction Manager will not be liable for increased labor costs, or errors or changes to the Prevailing Wage Rates or classifications.

B. Contractor shall provide reporting form as approved by the Owner. Contractor shall provide written evidence of the registration of apprenticeship programs and certification of trainee programs to comply with Department of Labor Requirements, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

C. At Project closeout, submit to Owner an Affidavit of Wages Paid, as approved by the Department of Labor and Industry. Owner will not release retainage and interest withheld until receipt of this Affidavit.

D. Failure on the part of the Prime Contractor to pay prevailing wages may result in contract payment delay, payment of a fee up to five percent (5%) of the contract or subcontract amount in question to the School District, cancellation of the contract and/or debarment. The value will be accessed against the portion of the contract that reflects the participation of the offending party. The assessment will not exceed the amount of withholding calculated by the Owner for that portion of the contract.

E. Appeal of administrative decision and actions will be by arbitration or litigation proceedings as specified in the contract documents for dispute resolution. Recommendation for debarment action will require action by the Board of Education.

1.7 WAGE RATE DETERMINATION DISPUTES

A. If wage compliance statements, audits, or other credible evidence establish that the Contractor or Subcontractor is not paying the Prevailing Wage, or if the Contractor or Subcontractor disputes the amounts withheld pursuant to current statutes, either party may submit the matter to expedited arbitration as follows:

1. The parties shall request an arbitrator from Minnesota pursuant its rules for expedited arbitration. Submitting a Bid on this Project shall be deemed a "written request" for arbitration within the meaning of Minnesota Rules
2. The arbitrator shall determine whether the affected employees were paid at the proper Prevailing Wage Rate. If the arbitrator determines that the employees were not properly paid, the arbitrator shall issue an award requiring the Contractor or Subcontractor to make the affected employees whole for the difference between the amount they were actually paid and the amount which they should have been paid under the Prevailing Wage Rate. In addition, the arbitrator shall award to the Owner and Program Construction Manager (as liquidated damages) an amount to cover administrative, legal, consulting, and similar costs incurred by the Owner and Program Construction Manager in settlement of the Prevailing Wage dispute.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 007343

SECTION 011100 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General provisions of the contract, including General and Supplementary Conditions and other Division 00 & 01 Specification Sections, apply to this Section.

B. Section 002413 "Scopes for Bid" for division of responsibilities for the Work.

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

D. Section 013100 "Project Management and Coordination."

E. Section 017300 "Execution."

F. Testing, Adjusting and Balancing Work, related to the mechanical systems will be performed under a separate, direct contract with the Owner.

1.2 SUMMARY

A. This section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements of each contract are also Indicated in individual Specification Sections and on Drawings.

C. Section Includes:
- Project information.
- Type of contract
- Work covered by Contract Documents.
- Work by Owner
- Contracts, General
- Access to site
- Work phases
- Utility Rebates
- Coordination with occupants
- Concurrent Projects
- Work restrictions
- Specification Formats and Conventions
- Definitions
- Watertight
- Future Work
- Owner-Furnished products
- contractor-Furnished, Owner-Installed products
- Owner’s Special Requirements

1.3 PROJECT INFORMATION

A. Project Name: Clinton-Graceville-Beardsley Schools, 2025 Addition & Renovations

B. Project Location: 712 East 3rd Street
Gracville, MN 56240

C. Owner: Clinton-Graceville-Beardsley District 2888
601 1st Street
Clinton, MN 56225
Contact: Brad Kelvington

D. Program Construction Manager: SitelogIQ, Inc.
7900 West 78th Street, Suite 400
Edina, MN 55439

1. Program Construction Manager has been engaged for this Project to serve as a construction Manager as an Adviser to Owner and to provide assistance in administering the contract for construction between Owner and each contractor, per separate contract between Owner and Program Construction Manager.
2. Program Construction Manager Representative: Darin Klein.

E. Architect: DesignArc Group
434 5th Street, Suite 1
Brookings, SD 57006

1.4 TYPE OF CONTRACT

A. Project will be constructed under coordinated, concurrent multiple contracts. Contracts for this Project are defined in Section 002413 "Scopes for Bid."

B. Nothing contained in contract Documents, and especially in the scope of Work, shall be construed as a Work assignment to construction industry trade. Each Contractor is responsible for their own decision on Work assignments and shall make them per prevailing practice in the locality of the Project, and in such a way that neither contractor's progress, nor progress of others, shall be adversely affected by contractor's decision.

C. There is no limit to number of contracts or combination of contracts any one contractor may bid. Owner reserves the right to award individual contracts or any combination of contracts per bids received.

D. Owner may purchase certain material and equipment items to be incorporated into Work by designated contractors. Designated contractor shall accept delivery and unload, handle, store, and install appropriate items. Upon delivery, designated contractor shall verify product suitability, quantity, quality, and condition as soon as it can be ascertained and shall accept care, custody, and control responsibility as it were their own purchase.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. General: Cooperate fully with separate contractors so Work on those contracts may be carried out smoothly, without interfering with or delaying Work under this contract.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly Installation of each part of the Work. Each Contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper Installation, connection, and operation.

C. Program Construction Manager will provide the coordination between the contractors and Owner and will be responsible for overseeing project coordination requirements and construction management on the project.

1. Program Construction Manager will generally manage milestone activities including but not limited to the following:
   a. Initiate overall sequencing of the Work.
   b. Coordinate overall shared access to workspaces.
   c. Coordinate product selections for compatibility.
   d. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make final connections for temporary services.
   e. Administer construction and operations of the Work with the Work performed by each contractor and Owner's employees and construction forces.
   f. Coordinate sequencing and scheduling of milestone activities of Work, including the following:
      1. Coordination Meeting: At earliest possible date, arrange and conduct a meeting with separate contractors for sequencing and scheduling the Work; negotiate reasonable adjustments to schedules.
      2. Prepare a combined overall construction schedule for entire Project, based schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from separate contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts.
      3. Distribute copies of schedules to Architect, Owner, and separate contractors.
   g. Each contractor shall Provide coordination as per Section 013100 "Project Management and Coordination."

D. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project Site. Those operations will be conducted simultaneously with Work under this contract.

1. General Trades Work Package #1
2. Mechanical Work Package #2
3. Electrical Work Package #3
4. Temperature Controls Work Package #4
5. TAB Work Package #5
6. Roofing Work Package #6

E. Owner will Furnish products as Indicated. When Furnishing products,

1. Owner will:
   a. Arrange for and deliver shop drawings, product data, and samples to contractor.
   b. Arrange and pay for delivery of Owner-Furnished items according to contractor's construction Schedule.
   c. Inspect delivered items for damage. contractor shall be present for and assist in Owner's inspection.
   d. Arrange for replacement of Owner-Furnished items that are damaged, defective, or missing.
   e. Arrange for manufacturer's field services and for delivery of manufacturer's warranties to contractor.
   f. Furnish contractor the earliest possible delivery date for Owner-Furnished products. Using Owner-Furnished earliest possible delivery dates, contractor shall designate delivery dates of Owner-Furnished items in Contractor's construction schedule.
2. Contractor shall:
   a. Review shop drawings, product data, and samples and return them to Architect noting discrepancies or anticipated problems in use of product.
   b. Receive, unload, and handle Owner-Furnished items at Project Site.

c. Protect Owner-Furnished items from damage during storage and handling, including damage from exposure to the elements.
d. Repair or replace Owner-Furnished items damaged as a result of Contractor's operations.
e. Install and otherwise incorporate Owner-Furnished items into the Work.

3. This Article 1.5E does not apply to Owner Pre-Purchased Equipment.

1.6 WORK BY OWNER

NOT USED

1.7 GENERAL CONDITIONS, RESPONSIBILITIES OF ALL CONTRACTORS

A. Each construction contract is responsible for a designated construction type, system and/or assembly, and unless otherwise Indicated, the scope of Work described in the Specification Section for each construction contract shall be a complete construction, system and/or assembly, including material, delivery, Installation, coordination, supervision, clean up and any accessories needed or required by the contract Documents. Each Contractor shall review all other construction contract scope of Work to become familiar with the other construction contract responsibilities, special requirements and inclusions and exclusions to the assignment and scope of Work.

B. Extent of contract: Although each contract involves an apparent segment of "conventional" subcontracting, multiple contract performance requires that adjustments be made to permit completion of a contract as a construction unit. Each Contractor shall review total scope of their responsibilities with respect to their Work and Provide for same in bid submittal.

C. Provisions of Section 007200 "General Conditions of the Contract for Construction," Supplementary Conditions, Division 00, and Division 01 apply to each contract.

D. Local custom and trade union jurisdictional settlements do not control the scope of the Work of each contract.

E. Nothing contained in contract Documents, and especially in scope of Work, shall be construed as a Work assignment to construction industry trade. Each Contractor is responsible for their own decision on Work assignments and shall make them per prevailing practice in local of the Project, and in such a way that neither Contractor's progress, nor progress of others, shall be adversely affected by Contractor's decision.

F. Mobilizations as required and scheduled by the Program Construction Manager.

G. Trenches and backfill for the Work of each contract shall be Provided by each Contractor for its own Work. Excess soils created by the excavation and back-fill operations are to be removed from the jobsite by that same contractor unless prior arrangements have been made.

H. Maintenance of safe working conditions for employees and others Working in vicinity; maintenance an ongoing safety program while on site. contractor shall submit a comprehensive safety plan to the Program Construction Manager upon award of contract.

I. Site Safety Plan: Contractors, Subcontractors and Sub-Subcontractors are required to review and participate in the Project Site safety management plan and safe Work practices as a minimum as prepared by the Program Construction Manager.

J. There is no limit to number of contracts or combination of contracts any one Contractor may Bid. Owner reserves the right to award individual contracts or any combination of contracts per Bids received.

K. Owner may purchase certain material and equipment items to be incorporated into Work by designated contractors. Designated contractor shall accept delivery and unload, handle, store, and Install appropriate items. Upon delivery, designated contractor shall verify product suitability, quantity, quality, and condition as soon as it can be ascertained and shall accept care, custody, and control responsibility as it were their own purchase.

L. Unless the Contract Documents contain a more specific description of the Work, names and terminology on drawings and in Specification Sections determine which contract includes a specific element of Project.

M. Attendance at pre-construction and site coordination meetings as scheduled by the Program Construction Manager during duration of contractors' Work on site. Comply with requirements of Section 013100 "Project Management and Coordination."
N. Fire caulking and/or firestop, etc. for the Work of each contract is to be Provided by that same contract for its' own Work (subs included). Fire caulking or firestop for walls floors, or other General items is to be Provided by the General construction Work package contractor.
O. Sealant and/or caulking for the Work of each contract shall be Provided by that same contract for its' own Work, unless otherwise noted.
P. Provide all project layout, levels, elevations, building lines, surveying as needed for Installation of this Work. Refer to Section 017300 "Execution."
Q. Openings or holes needed through walls, floors, or roof are to be laid out, cut, drilled or cored by contractor needing the opening, unless otherwise noted in the construction documents. contractor needing this is also to Provided miscellaneous metal frame, lintel or other support needed for that opening (labor and material complete).
R. Deliveries: Contractor shall coordinate, accept and unload their own site deliveries. Neither the Owner nor the Program Construction manager will not be responsible for deliveries to the contractors. Coordinate and make contact information available to the delivery services for expected deliveries.
S. Substitutions: Each Contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the Work.
T. Ongoing clean-up of Work area and removal of debris related to contractors' Work outside construction limits Indicated on Drawings. Comply with requirements of Section 015000 "Temporary Facilities and Controls."
U. Restoration of site locations disturbed by Contractors' Work outside construction limits Indicated on Drawings.
V. Coordination with Owner and other contractors on site and requirements of construction schedule as required and scheduled by the Program Construction Manager.
W. Temporary Facilities and Controls: In addition to specific responsibilities in this Section and Division 01, each contractor shall Provide the following:
    1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, and costs and use charges associated with each facility.
    2. Drinking water.
    3. Hand washing facilities.
    4. Telephone service for own use.
    5. Waste disposal facilities
        a. Waste disposal facilities for collection and legal disposal of its' hazardous, dangerous unsanitary, or other harmful waste materials.
    6. Weather sheltering: Temporary enclosure for protecting Work progress from rain, snow freezing, heat, which allows Work to continue when the outdoor conditions prevent Work from continuing. Include all heat, cooling or dehumidification, including all fuel or energy used for the above.
    7. Water for construction use, until the permanent city water service is completed and ready for use, water service is available from the Owner's existing source. Each Contractor to Provide their own hoses etc.
    8. Dust Protection.
    9. Temporary Walls. Barricades and cover related to Contractor Work for maintenance of security, safety, and cleanliness. Comply with requirements of Section 015000 "Temporary Facilities and Controls."
    10. Electrical power service – Each Contractor shall Provide its own power requirements over and above that Provided by the electrical contractor as defined by Section 015000 "Temporary Facilities and Controls" as needed for Installation of their own Work.
    11. Construction Aids:
        a. Ladders and other access devices needed for its own Work.

b. Fire protection for specific use or construction activity, such as but not limited to welding.
c. Electrical power cords.
d. Provide all necessary cranes, telescopic boom lifts, forklifts, scissor lifts, scaffolding, etc. to perform its own Work.

12. Lighting needs that exceed the lighting Provided by the electrical contractor as defined by Section 015000 "Temporary Facilities and Controls."
13. Access paths needed to Work area, material storage or staging is to be Provided by each Contractor for its own Work, except as describe specifically elsewhere in the Contract Documents. Storage and fabrication sheds.

X. Each contractor is responsible for scheduling and making arrangements with the testing service or quality control company (testing agency) that will Provide special testing services specified in Section 014000 "Quality Requirements" for the project. Testing requirements of the State of Minnesota not specifically Provided by the Owner are to be Provided by the Installing contractor.

Y. contractors shall collect Project Record Documents from sub-contractors and suppliers, collate Drawings and documents into numeric order, and submit complete set to the Program Construction Manager.

Z. Collect Record Specifications from their Subcontractors, collate Sections into numeric order, and submit complete set.
1. Collect operation and maintenance manuals for Contractors.

AA. Provide a full-time on-site Project Manager or Superintendent or Foreman when Work under Contractor's scope, including Subcontractors is being performed.

BB. Other items:
1. Its own field office complete with necessary furniture, utilities.
2. Temporary enclosures for its own construction activities.
3. All hoisting requirements for its own construction activities.
4. Secure lockup of its own tools, materials, and equipment. Secure lockup and protections for loss and damage for materials and equipment on site for incorporation into the Work. Progress cleaning; daily cleaning of the project by removing pallets, cardboard paper, plastic, wood, and other waste materials, scraps, and debris, such as, but not limited to, broken tools, reinforcement, sealant tubes, piping, conduit, roofing, sheet metal, flooring, insulation, steel studs, sheathing, GWB, ceiling materials, tiling materials, steel of all types, electrical wire, concrete, CMU, brick, or anything else that cannot be swept; removed from the building and site and placed in the dumpsters. contractors shall keep the site and all adjacent properties free of accumulations of waste and debris. Review Section 017300 "Execution," Article 3.6 for additional requirements. Failure to do so will result in the Owner having Work Provided by others and all associated costs will be deducted from the Contractor's Contract Sum by Change Order.

1.8 ACCESS TO SITE

A. General: Contractor's use of Project Site for construction operations is Indicated on Drawings by contract limits and as Indicated by requirements of this Section.

B. Use of Site: Limit use of Project Site to areas within contract limits Work in areas Indicated. Do not disturb portions of Project Site beyond areas in which Work is Indicated.
1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building:
1. Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period.

2. Repair damage caused by construction operations, as approved by Program Construction Manager, at no additional Cost to Owner.

1.9 WORK PHASES

A. The work will be conducted over two consecutive years starting April 1st, 2025, through August 21st, 2026, (or as agreed to by the Owner and Program Construction Manager for non-interrupting Work to the Owner's programs). The intent is to complete as much work as possible prior to the summer of 2026. To do this, some areas of the project will need to be completed or prepped this summer so work can continue in non-occupied areas during the school year. It is anticipated that some work can be done in unoccupied areas IF the following conditions can be met Safety of the Students and Staff at ALL TIMES, no disrupting noise or odors and / or any other actions the owner may deem as non-permissible. Note: There may be periods of time that work will stop due to these limitations or availability of areas to work in.

B. Areas Designated as Phase 1 thru Phase 5 are outlined on Phasing Plan shown on Drawing A1.0.
   1. Phase 1 Gym, Locker Rooms, Multipurpose and Wellness Addition can start Spring of 2025 and must be Substantially Complete by February 20, 2026.
   2. Phase 1* Pre-K Addition can start Spring of 2025 and must be Substantially Complete by July 22, 2026.
   3. Phase 2 can start Spring of 2025 and must be Substantially Complete by December 26, 2025.
   4. Phase 3 can start May 26, 2025, and must be Substantially Complete by August 22, 2025.
   5. The FACS, Shop and Shop Classroom demolition and renovation areas of Phase 4 can start after the completion of Phase 2. The remaining areas of Phase 4 can start after completion of Phase 1 Gym, Locker Rooms, Multipurpose and Wellness Addition completion. Phase 4 must be Substantially Complete by August 21, 2026.
   6. Phase 5 can start Fall of 2025, and must be Substantially Complete by August 21, 2026.
   7. Note: All building, mechanical, electrical, automation system, IT systems in Areas A & B including related infrastructure and communications network must be left functional such that the systems remain operable through the 2025/2026 academic year or until such time as the equipment is removed from the project in year two.

C. It is anticipated that some Work can be done in unoccupied areas. However, if the following conditions can be met Safety of all entrants to the property, including but not limited to students and staff at ALL TIMES, no disrupting noise or odors, and any other actions the owner may deem as non-permissible, Work may be permitted in occupied areas. Note: There may be periods of time that Work will stop due to these limitations or availability of areas to work in.

D. Upon receipt of a "Notice to Proceed", all successful contractors shall commence preparation of their respective equipment submittals such that all long lead time shop drawings and submittal data, including but not limited to structural steel, air handling equipment, boilers, chillers, finned tube, will be submitted for review to Program Construction Manager within fourteen (14) days of notice to proceed. The remaining shop drawings and submittal data will be submitted for review to Program Construction Manager prior to the first mandatory pre-construction meeting.

E. Building Heat will be turned off on or about [insert date] (weather dependent). The demolition and Installation of new heating lines in non-occupancy interfering areas may commence following this date.

F. All Work prior to March 1, 2025 must be coordinated with the Owner and Program Construction Manager so as not to disrupt occupied areas of the building and maintain safety for all occupants.

G. Within fourteen (14) days of receipt of a "Notice to Proceed", all successful contractors shall submit a basic schedule showing the sequence of Work including commencement dates and construction durations. This schedule will be fine-tuned during the mandatory pre-construction meeting with all trades prior to the start of work, however the rough guideline below outlines our plan.

Task Name	Start	Finish
Phase 1 Gym, Locker Rooms, Multipurpose and Wellness Addition	Spring, 2025	Feb 20, 2026
Phase 1* Pre-K Addition New Construction	Spring, 2025	July 22, 2026
Anticipated Phase 1 Dirt Work/Foundation	April 11, 2025	May 30, 2025
Precast Wall Panels to arrive on-site (By Pre-Cast Contractor)		May 16, 2025
Anticipated Structural Steel to arrive on-site (By General Trades)		June 15, 2025
Anticipated Phase 1 Roofing Work to be Completed - Watertight		September 11, 2025
Electrical Switch Gear (MSB2) to arrive on-site (Owner Provided)		April, 2025
Phase 2	Spring, 2025	Dec 26, 2025
Phase 3 Demo/Renovation	May 26, 2025	Aug 22, 2025
Phase 3 Floor Protection	May 26, 2025	May 26, 2025
Phase 4 Demo/Renovation	Feb 23, 2026	Aug 21, 2026
Phase 4 Floor Protection	Feb 23, 2026	Feb 20, 2026
Phase 5	Fall, 2025	Aug 21, 2026

H. All contractors shall acknowledge that this Project will require a coordinated effort to complete all trades Work prior to the substantial completion dates stated in section Work-Phases 1.9.B above. Individual trades shall, under direction of the Program Construction Manager, adjust their schedules, manpower, etc. to accomplish total project completion by all trades within the duration of the project phase. Enforcement of this Article 1.9 shall be consistent with Section 007200 “General Conditions of the Contract for Construction,” Section 8.3.1.1.

I. No construction material, parts, tools, job boxes will be permitted to be stored inside the building phase under construction beyond the substantial completion date outlined above in section Work-Phases 1.9.B above, without prior approval of the Program Construction Manager or Owner.

J. Within five (5) days of receipt of a punch list following substantial completion each contractor shall submit a punch list completion schedule, as outlined in Section 007200 “General Conditions of the Contract for Construction,” Section 9.8.2.1. All Installation trades punch list items shall be completed no later than the stated completion date. All temperature control punch list items completed no later than the stated completion date for this Work package.

1.10 UTILITY REBATES

A. As requested by the Program Construction Manager, or agents thereof, contractor shall Provide all invoicing and product information necessary to procure all applicable utility rebates, within two (2) weeks of request.

B. Owner shall be the beneficiary to all rebates.

1.11 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy premises during entire construction period, with exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts

and facilitate Owner usage. Perform Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise Indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than seventy-two (72) hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of construction: Owner reserves right to occupy and to place and Install equipment in completed portions of Work, prior to Substantial Completion of Work, provided such occupancy does not interfere with completion of Work. Such placement of equipment and limited occupancy shall not constitute acceptance of total Work.

1. Program Construction Manager will prepare Certificate of Substantial Completion for each specific portion of Work to be occupied prior to Owner acceptance of completed Work.
2. Obtain Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

C. Owner Occupancy of Completed Areas of construction: Owner reserves the right to occupy and to place and Install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Program Construction Manager will prepare a Certificate of Substantial Completion when Work is completed to an acceptable point and owner is able to use the whole facility for its intended purpose.
    a. Prior to issuance of certificate, contractors must obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
    b. Before Owner occupancy, the mechanical, electrical, fire alarm and fire protection systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
    c. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.12 CONCURRENT PROJECTS

A. The following projects not outlined in these construction documents shall take place concurrently with construction efforts outlined within.

1. Any Abatement if needed.

B. Contractors will Work with the Program Construction Manager and other trades as required to ensure a mutually coordinated project, so as to not interfere with efforts of other trades.

1.13 WORK RESTRICTIONS

A. Work restrictions, generally: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit Work in existing building to normal business Working hours of 6:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise Indicated.

1. Coordinate Work outside of this time frame with Owner's Representative.
2. Comply with local noise restriction requirements for noise levels and hours of acceptance, such as no outside noise earlier than 7:00 a.m.
3. Additional Workdays and Work hours are expected on this project. Project is fast track with completion expected no later than dates indicated in section 011100 "Summary of work" 1.9 – Work Phases (with Certificates), Additional hours and/or weekends is to be expected and included in contractor's price. Prior approval by the Program Construction Manager and Owner, ahead of time so arrangements can be made with owner and Program Construction Manager.

C. No steel wheeled dollies or pallet jacks allowed on the site.

D. Diaper all 'lifts' for oil and acid leaks. All 'lifts will have white tires.

E. Work requiring oil is not allowed on finished floors, on exposed concrete floors including exterior concrete, and on concrete where a finish floor will be Installed. At all times protective plastic or tarps under plywood will be used.

F. Storage is not available, intended or guaranteed within the building for building materials and equipment, and for contractors' equipment and tools. All materials, equipment, and tools stored within the building will be moved immediately when required and when request by another contractor, Owner, or Program Construction Manager.
1. Provide weather tight and secured storage trailers or buildings.
2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

G. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services per requirements Indicated:
1. Notify Owner's Representative not less than two (2) days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

1.14 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "Master Format" numbering system.
1. Section Identification: The Specifications use Section numbers and titles to help cross referencing in the contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the contract Documents.
2. Division 00: Sections in Division 00 contracting Requirements: General Provisions of the contract, including General and Supplementary Conditions apply to all Sections in the Specifications
3. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
4. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
    a. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
    b. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
    c. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by contractor or by others when so noted.
   3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   4. “Related Sections” include a list of products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
   5. Specification requirements are to be performed by contractor unless specifically stated otherwise.

1.15 DEFINITIONS

A. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "Directed."

B. "Experienced": When used with an entity, "Experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements Indicated; and having complied with requirements of authorities having jurisdiction.

C. “Finish Work”: Includes Work that pertain to gypsum wall board taping, applying joint compound and sanding; plastering; painting and wall covering; flooring; ceilings; casework; doors and hardware; and wood Working.

D. "Furnish": Supply and deliver to Project Site, ready for unloading, unpacking, assembly, Installation, and similar operations.

E. General: Basic contract definitions are included in the Conditions of the Contract for Construction.

F. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "Indicated."

G. "Install": Operations at Project Site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, Working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Installer": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including Installation, erection, application, and similar operations.
   1. Using a term 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 trades people of the corresponding generic name.

I. “Permanent Enclosure”: As determined by Architect, permanent roofing is complete, insulated, and weather-tight; exterior walls are insulated and weather-tight; and all exterior openings are closed with

permanent construction. The point when the exterior construction will no longer affect the interior construction activities.

J. "Project Site": Space available for performing construction activities. The extent of Project Site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

K. "Provide": Furnish and Install, complete and ready for the intended use.

L. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work

M. "Reviewed": When used to convey Architect's action on contractor's submittals, applications, and requests, "Reviewed" is limited to Architect's duties and responsibilities as stated in the Conditions of the contract.

N. "Smoke": The term "Smoke" shall include smoking a cigarette, cigar, or pipe; or carrying a lighted cigarette, cigar or pipe.

O. "Tobacco Product": The term "use of Tobacco Product" shall include the chewing of tobacco or snuff or the consumption of any other Tobacco Product.

1.16 WATERTIGHT

A. Anything in the contract Documents notwithstanding, the contractor accepts the responsibility of constructing a watertight, weather tight project.

B. Discovery of Fungi (Mold): In accordance with this Article, contractor is responsible for providing labor, material, products, equipment and services to Install insulation, air/vapor barrier, and ventilation systems that maintain effective control of air, moisture, and heat transfer within the building envelope.

1. Should contractor proceed to Install insulation, ceiling tiles, gypsum wallboard or similar products having paper, cardboard and other cellulose surfaces prior to the building’s being enclosed and weatherproof (including ambient conditions of temperature and humidity being continuously maintained at values near those Indicated for final occupancy), the contractor is at risk for mold contamination of the building components.
2. During the course of construction of the Project, contractor shall perform continuous visual inspection/verification of building components and ventilation systems (particularly for damp filters) for possible contamination by mold.
3. If the presence of mold is suspected, detected or found, visible water damage observed or musty odors detected, immediate remediation action shall be initiated by the contractor. In all instances, any source(s) of water shall be stopped, and the extent of water damage determined. Water-damaged materials shall be immediately removed and replaced with new materials at the contractor’s expense. The contractor shall Provide an approved independent test report documenting the completed environmental status.
    a. Mold-damaged materials shall be remedied in accordance with contractor’s Mold Remediation Plan.

1.17 FUTURE WORK

NOT USED

1.18 OWNER FURNISHED PRODUCTS

NOT USED

1.19 CONTRACTOR FURNISHED – OWNER INSTALLED PRODUCTS

NOT USED

1.20 OWNERS SPECIAL REQUIREMENTS

A. Refer to Section 013513 "Special Project Procedures."

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 011100

SECTION 012200 – 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 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

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 delivery, installation, insurance, applicable taxes**,** 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.

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.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Back Fill
   1. Unit of Measurement: Cubic Yard
   2. Quantity Allowance: Unit Price Per Cubic Yard to Remove and Install new

B. Unit Price No. 2: Sidewalk
   1. Description: Sidewalk
   2. Unit of Measurement: Square Foot 1ft x 1ft x 4inch depth
   3. Quantity Allowance: Unit Price Per Square Foot to Remove and Install new

END OF SECTION 012200

SECTION 012300 – ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for Alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by Bidders and stated on Bid Form for certain Work defined in Bidding requirements that may be added to or deducted from base Bid amount if Owner decides to accept corresponding change either in amount of construction to be completed, or in products, materials, equipment, systems, or installation methods described in Contract Documents.
   1. Alternates described in this Section are part of Work only if enumerated in Agreement.
   2. Cost or credit for each alternate is net addition to or deduction from Contract Sum to incorporate alternate into Work. No other adjustments are made to Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent Work as necessary to completely integrate Work of alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for complete installation whether or not indicated as part of alternate.
   2. Include as part of each alternate all costs associated with coordination, revision, or adjustment.

B. Notification: Immediately following award of contract, notify each party involved, in writing, of status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include complete description of negotiated revisions to alternates.

C. Execute accepted alternates under same conditions as other Work of contract.

D. Schedule: Schedule of alternates is included at end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve Work described under each alternate.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: North Parking Lot Asphalt
   1. Per contract documents, provide deduction cprice for removing the north parking asphalt from scope and graded gravel parking lot to remain.
   2. Each trade shall review and price all work associated with their trade as well as any required coordination with other trades.

B. Alternate No. 2: East Safe Routes Sidewalk
   1. Per contract documents, provide all labor and materials necessary for the East Safe Routes Sidewalk
   2. Each trade shall review and price all work associated with their trade as well as any required coordination with other trades.

C. Alternate No. 3: West Safe Routes Sidewalk
   1. Per contract documents, provide all labor and materials necessary for the West Safe Routes Sidewalk
   2. Each trade shall review and price all work associated with their trade as well as any required coordination with other trades.

D. Alternate No.4: The base bid is a 30-year warranted design (60 mil fleece-back KEE). The alternate is a deduction for a 20-year warranted design (45 mil fleece-back KEE)
   1. Per contract documents, provide all pricing associated with labor and materials necessary for the deduction for a 20–year warranted design.
   2. Each trade shall review and price all work associated with their trade as well as any required coordination with other trades.

E. Alternate No.: 5. The base bid has a 1/4" dens deck prime coverboard set in low-rise foam adhesive on all roof areas. The alternate is a deduction to remove the cover board from Roof A1, C1, C2, C4 & C5.
   1. Per contract documents, provide all labor and materials necessary for a deduction to remove the cover board from Roof A1, C1, C2, C4 & C5.
   2. Each trade shall review and price all work associated with their trade as well as any required coordination with other trades.

F. Alternate No.: 6. At FACS area 209, provide alternate cost for “commercial learning equipment”. See elevations on page A3.8.
   1. Per contract documents, provide all labor and materials necessary for the Commercial Learning Equipment
   2. Each trade shall review and price all work associated with their trade as well as any required coordination with other trades.

END OF SECTION 012300

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use facsimile of form provided in Section 006325 "Substitution Request Form" or CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including list of changes or revisions needed to other parts of Work and to construction performed by Owner and separate Contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      h. Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project.
      j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for Work, including effect on overall Contract Time. If specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Program Construction Manager or Architect will request additional information or documentation for evaluation within seven (7) days of receipt of request for substitution. Program Construction Manager/Architect will notify Contractor, through Program Construction Manager of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in Work.
   b. Use product specified if Program Construction Manager/Architect does not issue decision on use of proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected Work as necessary to integrate Work of approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Requested substitution provides sustainable design characteristics that specified product provided.
      c. Substitution request is fully documented and properly submitted.
      d. Requested substitution will not adversely affect Contractor's construction schedule.
      e. Requested substitution has received necessary approvals of authorities having jurisdiction.
      f. Requested substitution is compatible with other portions of Work.
      g. Requested substitution has been coordinated with other portions of Work.
      h. Requested substitution provides specified warranty.
      i. If requested substitution involves more than one (1) contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to contractors involved.
      j. Incurred costs of other contractors affected by the substitution will be borne by the contractor requesting the substitutions.

B. Substitutions for Convenience: Program Construction Manager and Architect will consider requests for substitution if received within thirty (30) days after Notice of Award. Requests received after that time may be considered or rejected at discretion of Program Construction Manager and Architect.

1. Conditions: Program Construction Manager and Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Program Construction Manager and Architect will return requests without action, except to record noncompliance with these requirements:
   a. Requested substitution offers Owner substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Program Construction Manager and Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   b. Requested substitution does not require extensive revisions to Contract Documents.
   c. Requested substitution is consistent with Contract Documents and will produce indicated or greater results.
   d. Requested substitution provides sustainable design characteristics that specified product provided.
   e. Substitution request is fully documented and properly submitted.
   f. Requested substitution will not adversely affect Contractor's construction schedule.
   g. Requested substitution has received necessary approvals of authorities having jurisdiction.
   h. Requested substitution is compatible with other portions of Work.
   i. Requested substitution has been coordinated with other portions of Work.
   j. Requested substitution provides specified warranty.
   k. If requested substitution involves more than one (1) Contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to contractors involved.
   l. Incurred costs of other contractors affected by the substitution will be borne by the contractor requesting the substitutions.

PART 3 - EXECUTION~~PRODUCTS~~

NOT USED

END OF SECTION 012500

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Administrative and procedural requirements for handling and processing contract modifications.

1.2 MINOR CHANGES IN WORK

A. Program Construction Manager will issue supplemental instructions authorizing minor changes in Work, not involving adjustment to Contract Sum or Contract Time, on AIA Document G710-2017, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Program Construction Manager will issue detailed description of proposed changes in Work that may require adjustment to Contract Sum or Contract Time. If necessary, description will include supplemental or revised Drawings and Specifications.
1. Work Change Proposal Requests issued by Program Construction Manager are not instructions either to stop Work in progress or to execute proposed change.
2. Within time specified in Proposal Request or seven (7) days, when not otherwise specified, after receipt of Proposal Request, submit quotation estimating cost adjustments to Contract Sum and Contract Time necessary to execute change.
a. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to change.
d. Include updated Contractor's construction schedule that indicates effect of change, including changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting extension of Contract Time.
e. Quotation Form: Forms acceptable to Program Construction Manager.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to contract, Contractor may initiate claim by submitting request for change to Program Construction Manager.
1. Include statement outlining reasons for change and effect of change on Work. Provide complete description of proposed change. Indicate effect of proposed change on Contract Sum and Contract Time.
2. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to change.
5. Include updated Contractor's construction schedule that indicates effect of change, including changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting extension of Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if proposed change requires substitution of one (1) product or system for product or system specified.
7. Proposal Request Form: Use forms acceptable to Program Construction Manager.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of Proposal Request, Program Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G731.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Program Construction Manager may issue a Construction Change Directive on AIA Document G733. Construction Change Directive instructs Contractor to proceed with change in Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains complete description of change in Work. It also designates method to be followed to determine change in Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on time and material basis of Work required by Construction Change Directive.
   1. After completion of change, submit itemized account and supporting data necessary to substantiate cost and time adjustments to Contract.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 012600

AIA® Document G732™ – 2009

Application and Certificate for Payment, Construction Manager as Adviser Edition

TO OWNER: **PROJECT:** Sample Project **APPLICATION NO:** 001 **Distribution to:**

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

PERIOD TO:
CONTRACT DATE:
PROJECT NOS: / /

FROM CONTRACTOR:
CONTRACT FOR:

VIA CONSTRUCTION MANAGER:
VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM	$0.00
2. NET CHANGE BY CHANGE ORDERS	$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	$0.00
5. RETAINAGE:	
a. 0 % of Completed Work (Column D + E on G703)	$0.00
b. 0 % of Stored Material (Column F on G703)	$0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	$0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)	$0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)	$0.00
8. CURRENT PAYMENT DUE	$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$0.00	$0.00
Total approved this month including Construction Change Directives	$0.00	$0.00
TOTALS	$0.00	$0.00
NET CHANGES IN THE WORK		$0.00

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 $0.00

(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:

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.

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document, G702TM–1992, Application and Certification for Payment, or G736TM–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
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		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)
			FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD					
		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**

SECTION 012900 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of Schedule of Values with preparation of Contractor's construction schedule.
   1. Correlate line items in Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit Schedule of Values to Program Construction Manager at earliest possible date but no later than seven (7) days before date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for Schedule of Values. Provide at least one (1) line item for each Specification Section.
   1. Identification: Include the following Project identification on Schedule of Values:
      a. Project name and location.
      b. Name of Program Construction Manager.
      c. Program Construction Manager's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Submit draft of AIA Document G703.
   3. Arrange 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 as a percentage of Contract Sum to nearest 1/100 percent (0.01%), adjusted to total 100 percent (100%).
         1) Labor.
         2) Materials.
         3) Equipment.
   4. Provide a breakdown of Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.
   5. Round amounts to nearest whole dollar; total shall equal Contract Sum.
   6. Provide separate line items in Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of work.

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

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Program Construction Manager and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Submit progress payments to Program Construction Manager by 1st of month unless indicated otherwise in Agreement. Period covered by each Application for Payment is one (1) month, ending on last day of the month unless indicated otherwise in Agreement.

C. Application for Payment Forms: Use AIA Document G732 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Program Construction Manager will return incomplete applications without action.
    1. Entries shall match data on Schedule of Values and Contractor's construction schedule. Use updated schedules if revisions were made.
    2. Entries shall delineate retention in the amount of five percent (5%) for each line item and in total for the project through completion of the duly approved value of work performed under the contract as of the date of application for payment until final completion and acceptance of all work covered by the contract. The Contractor will not be paid interest on retained amount.
    3. Include amounts for Work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
    4. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
    1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
    2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
    3. Provide summary documentation for stored materials indicating the following:
        a. Materials previously stored and included in previous Applications for Payment.
        b. Work completed for this Application utilizing previously stored materials.
        c. Additional materials stored with this Application.
        d. Total materials remaining stored, including materials with this Application.

F. Transmittal: Submit two (2) signed and notarized original copies of each Application for Payment to Program Construction Manager by a method ensuring receipt within twenty-four (24) hours. One (1) copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of contract and related to work covered by payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of Subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Schedule of unit prices.
   6. Submittal schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Performance and payment bonds.
   15. Data needed to acquire Owner's insurance.
   16. Initial settlement survey and damage report if required.

I. Application for Payment at Substantial Completion: After issuing Certificate of Substantial Completion, submit Application for Payment showing 100 percent (100%) completion for portion of work claimed as substantially complete.
   1. Include documentation supporting claim that work is substantially complete and a statement showing an accounting of changes to Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final "Record Documents" on clean plans.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 012900

SECTION 012901 – STORED MATERIAL FORM

Made this _____ day of _____ in the year 20__
(Date) (Month)

Between the Owner: Clinton-Graceville Beardsley District 2888, 601 1st Street, Clinton, MN 56225

and the Contractor: _____
(Name and Address)

for the following project: Clinton-Graceville Beardsley Schools, 2025 Addition & Renovations, 712 East 3rd Street, Graceville, MN 56240, Project Number BP-CGB-PCST-25

The Owner and the Contractor understand and agree that a portion of the total completed and stored to date shown on the Application for Payment No. ____ represents an amount for the material to be furnished and installed under their agreement dated _____ and that this material is to be stored at:

_____
(Storage Location)

_____
(Street Address)

_____
(City) (State) (Zip Code)

a location other than the site, under the following conditions:

1. Materials stored at the above location shall be plainly tagged or marked by the Contractor as property of Clinton-Graceville Beardsley District 2888.
2. Such materials shall be separately located and segregated by the Contractor from other materials at the place of storage.
3. Such materials shall be kept free of liens or encumbrances by the Contractor and shall be kept adequately insured against loss to the Owner by theft, fire, or other casualty at the expense of the Contractor, and proof of such insurance will be furnished to the Owner.
4. Such material shall be stored as herein provide and moved to the site without delaying the Work and without expense to the Owner.
5. Consent of Surety to enter into the off-site stored materials and equipment agreement shall be furnished to the Owner.

Owner:_____
(Sign name, same as agreement)

Contractor:_____
(Sign name, same as agreement)

END OF SECTION 012901

SECTION 012902 – CONSENT OF SURETY COMPANY TO OFF-SITE STORAGE AGREEMENT

PROJECT: Clinton-Graceville Beardsley Schools
2025 Addition & Renovations
712 East 3rd Street
Graceville, MN 56240

TO (Owner): Clinton-Graceville Beardsley District 2888
601 1st Street
Clinton, MN 56225
Contact: Brad Kelvington.

- ❑ OWNER
- ❑ PROGRAM CONSTRUCTION MANAGER
- ❑ ARCHITECT
- ❑ CONTRACTOR
- ❑ SURETY
- ❑ OTHER

CONTRACTOR: CONTRACT DATE:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the (here insert name and address of Company)_____
SURETY COMPANY

on bond of (here insert name and address of Contractor) _____
CONTRACTOR

hereby approves the attached off-site agreement with the Contractor, and agrees that off-site storage agreement shall not relieve the Surety Company of any of its obligations to Clinton-Graceville Beardsley District 2888 as set forth in the said Surety Company's bond.

IN WITNESS WHEREOF,

THE SURETY COMPANY HAS HEREUNTO SET ITS HAND THIS _____DAY OF _____.

_____
Surety Company

_____
Signature of Authorized Representatives

Attest:

(Seal):

_____
Title

END OF SECTION 012902

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative provisions for coordinating construction operations on Project including the following:
      a. General coordination procedures.
      b. Coordination Drawings.
      c. Requests for Information (RFIs).
      d. Project meetings as required.
      e. Digital Project management procedures
      f. Web based Project management software package.
      g. Project meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to specific contractor.

C. Related Requirements:
   1. Section 002413 "Scopes for Bid." For description of division of work among separate contracts and responsibility for coordination activities not in this Section 013100 "Project Management and Coordination."
   2. Section 017300 "Execution." For procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Section 017700 "Closeout Procedures." For coordinating closeout of contract.
   4. Section 019113 "HVAC and Electrical Commissioning Requirements." For coordinating work with Owner's commissioning authority.

1.2 DEFINITIONS

A. BIM: Building Information Modeling

B. RFI: Request from Owner, Program Construction Manager, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare written summary identifying individuals or firms proposed for each portion of work, including those who are to furnish products or equipment fabricated to special design. Include the following information in tabular form:
   1. Name, address, and telephone number of the 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.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit list of key personnel assignments, including Superintendent and other personnel in attendance at Project Site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, in web based project software directory and in prominent location in each facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

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

B. Coordination for Multiple Prime Contract: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of Work. Each Contractor shall coordinate its operations with operations, included in different sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain best results where installation of one (1) part of Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and direction of Program Construction Manager to avoid conflicts and to ensure orderly progress of Work. Such administrative activities include the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: If necessary or called for by Program Construction Manager, prepare coordination drawings per requirements in individual sections, and additionally where installation is not completely shown on shop drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable drawings as basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate addition of trade-specific information to coordination drawings by multiple contractors in sequence that best provides for coordination of information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during life of installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent work.
   2. Plenum Space: Indicate sub framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
   3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   6. Mechanical and Plumbing Work: Show the following:
      a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
      b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
      c. Fire-rated enclosures around ductwork.
   7. Electrical Work: Show the following:
      a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
      b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
      c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
      d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   8. Fire-Protection System: Show the following:
      a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that Work is being coordinated, but not for details of coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints per requirements in Section 013300 "Submittal Procedures."

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Preparation Format: **DWG** Version 10 operating in **Microsoft Windows** operating system.
3. File Submittal Format: Submit or post coordination drawing files using **PDF format**.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of need for additional information or interpretation of Contract Documents, Contractor shall prepare and submit RFI in form specified.
1. Program Construction Manager will return without response those RFIs submitted by other entities controlled by Contractor.
2. Coordinate and submit RFIs in prompt manner so as to avoid delays in Contractor's Work or work of Subcontractors.

B. Content of RFI: Include detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Program Construction Manager.
6. RFI number, numbered sequentially.
7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or software-generated form with substantially same content as indicated above, acceptable to or as provided by Program Construction Manager.
1. Attachments shall be electronic files in PDF format.

D. Program Construction Manager's Action: Program Construction Manager will review each RFI, determine action required, and respond. Allow seven (7) working days for Program Construction Manager's response for each RFI. RFIs received by Program Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in Contract Documents.
    e. Requests for adjustments in Contract Time or Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Program Construction Manager's action may include request for additional information, in which case Program Construction Manager's time for response will date from time of receipt of additional information.
3. Program Construction Manager's action on RFIs that may result in change to Contract Time or Contract Sum may be eligible for Contractor to submit Change Proposal per Section 012600 "Contract Modification Procedures."
    a. If Contractor believes RFI response warrants change in Contract Time or Contract Sum, notify Program Construction Manager in writing within three (3) days of receipt of RFI response.

E. RFI Log: Program Construction Manager will update and maintain Project log.

F. On receipt of Program Construction Managers action, review response and notify the Program construction manager within seven days if contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Data Files Not Available: Architect will not provide Architect's digital data files for Contractor's use during construction unless purchased by the contractor as outlined in Section 013333 "Electronic Drawings."
1. Revise first subparagraph below if Architect's instruments of service are to be used by other entities and are not covered by another data licensing agreement. Coordinate with provisions of Owner/Architect Agreement and Supplementary Conditions.

2. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106 Agreement included in this Project Manual

B. Web-Based Project Management Software Package: Use Program Construction Manager's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project management software includes, at a minimum, the following features:
   a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
   b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
   c. Document workflow planning, allowing customization of workflow between project entities.
   d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
   e. Track status of each Project communication in real time, and log time and date when responses are provided.
   f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
   g. Processing and tracking of payment applications.
   h. Processing and tracking of contract modifications.
   i. Creating and distributing meeting minutes.
   j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
   k. Management of construction progress photographs.
   l. Mobile device compatibility, including smartphones and tablets.
2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Program Construction Manager. Provide data in locked format to prevent further changes.
3. Provide the following Project management software packages under their current published licensing agreements:
   a. Procore Technologies, Inc.

C. PDF Document Preparation: Where PDFs are required to be submitted to Program Construction Manager, prepare as follows:
1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Program Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
2. Agenda: Prepare meeting agenda. Distribute agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute meeting minutes to everyone concerned within three (3) days of meeting.

B. Pre-Construction Conference: Program Construction Manager will schedule and conduct preconstruction conference.
   1. Conduct conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Program Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend conference. Participants at conference shall be familiar with Project and authorized to conclude matters relating to Work.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Responsibilities and personnel assignments.
      b. Tentative construction schedule.
      c. Phasing.
      d. Critical Work sequencing and long-lead items.
      e. Designation of key personnel and their duties.
      f. Lines of communications
      g. Use of web based project software.
      h. Procedures for processing field decisions and Change Orders.
      i. Procedures for RFIs.
      j. Procedures for testing and inspecting.
      k. Procedures for processing Applications for Payment.
      l. Distribution of Contract Documents.
      m. Submittal procedures.
      n. Preparation of record documents.
      o. Use of premises
      p. Work restrictions.
      q. Working hours.
      r. Owner's occupancy requirements.
      s. Responsibility for temporary facilities and controls.
      t. Procedures for moisture and mold control.
      u. Procedures for disruptions and shutdowns.
      v. Construction waste management and recycling.
      w. Parking availability.
      x. Office, work, and storage areas.
      y. Equipment deliveries and priorities.
      z. First aid.
      aa. Security.
      bb. Progress cleaning.
   4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-Installation Meetings: Conduct pre-installation meeting at Project Site before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend meeting. Advise Program Construction Manager and Owner's Commissioning Authority of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for particular activity under consideration, including requirements for the following:
      a. Contract Documents.

b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mock-ups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other Work.
w. Required performance results.
x. Protection of adjacent Work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

D. Project Closeout Conference: Program Construction Manager will schedule and conduct Project closeout conference, at time convenient to Owner.
1. Conduct conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner’s Commissioning Authority, Program Construction Manager, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend meeting. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.

j. Coordination of separate Contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Program Construction Manager will conduct progress meetings at weekly or regular intervals.

1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Program Construction Manager, each contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to work.
2. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

F. Coordination Meetings: Program Construction Manager will conduct Project coordination meetings at weekly or regular intervals.

1. Attendees: In addition to representatives of Owner's Commissioning Authority, Program Construction Manager, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. Participants at meetings shall be familiar with Project and authorized to conclude matters relating to work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Combined Contractor's Construction Schedule: Review progress since last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
   c. Review present and future needs of each contractor present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Deliveries.
      5) Off-site fabrication.
      6) Access.
      7) Site utilization.
      8) Temporary facilities and controls.
      9) Work hours.
      10) Hazards and risks.
      11) Progress cleaning.
      12) Quality and work standards.
      13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 013100

SECTION 013300 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Requirements for submittal schedule.
2. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures." For submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination." For submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 014000 "Quality Requirements." For submitting test and inspection reports, and schedule of tests and inspections.
4. Section 017700 "Closeout Procedures." For submitting closeout submittals and maintenance material submittals.
5. Section 017823 "Operation and Maintenance Data." For submitting operation and maintenance manuals.
6. Section 017839 "Project Record Documents." For submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Program Construction Manager’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 Program Construction Manager’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. Days: Where specific number of days are indicated, these refer to calendar days.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Program Construction Manager and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit as soon as possible, at minimum within fourteen (14) days after the Notice to Proceed or Contract Award is received leaving a minimum of thirty (30) days for review cycle to process.
3. Final Submittal: Submit concurrently with 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 tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action or Informational.
   d. Name of Subcontractor.
   e. Description of work covered.
   f. Scheduled date for Program Construction Manager's final release or approval.
   g. Scheduled date of fabrication.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
   1. Project name.
   2. Date.
   3. Name of Program Construction Manager.
   4. Name of Contractor.
   5. Name of firm or entity that prepared submittal.
   6. Names of subcontractor, manufacturer, and supplier.
   7. Category and type of submittal.
   8. Submittal purpose and description.
   9. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
   10. Drawing number and detail references, as appropriate.
   11. Indication of full or partial submittal.
   12. Location(s) where product is to be installed, as appropriate.
   13. Other necessary identification.
   14. Remarks.
   15. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Program Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. When using Paper Submittals:
   1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
   2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Program Construction Manager
   3. Retain Action Submittals and Informational Submittals subparagraphs below as default requirements for paper copies of submittals; other quantity requirements may be included with individual submittal requirements elsewhere in this article. Additional copies may be required for projects with a construction manager or a commissioning authority.
   4. Action Submittals: Submit three (3) paper copies of each submittal unless otherwise indicated. Program Construction Manager will return two (2) copies.
   5. Informational Submittals: Submit two (2) paper copies of each submittal unless otherwise indicated. Program Construction Manager will not return copies.
   6. Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Program Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

7. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using Program Construction Manager's transmittal form.

E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's/Engineer's Digital Data Files: At Contractor's written request, electronic digital data files of Contract Drawings will be provided by Architect for Contractor's use in connection with this Project only.
1. Architect will furnish Contractor digital data drawing files of Contract Drawings for use in preparing shop drawings and record drawings.
a. Architect makes no representations as to accuracy or completeness of digital data drawing files as they relate to Contract Drawings.
b. Digital Drawing Software Program: Verify with Architect/Engineer the software program used for Drawings.
c. Contractor shall execute data licensing agreement in form of AIA Document C106, Digital Data Licensing Agreement, or agreement form acceptable to Owner and Architect.
d. The following digital data files will by furnished for each appropriate discipline:
1) None

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. Coordinate transmittal of different types of submittals for related parts of work so processing will not be delayed because of need to review submittals concurrently for coordination.
a. Architect and Program Construction Manager reserve the right to withhold action on 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 Program Construction Manager's receipt of submittal. No extension of Contract Time will be authorized because of failure to transmit submittals enough in advance of work to permit processing, including resubmittals.
1. Initial Review: Allow seven (7) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Program Construction Manager will advise Contractor when 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 seven (7) days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Consultants, Owner, or other parties is indicated, allow twenty-one (21) days for initial review of each submittal.

D. Submittals: Place permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide space approximately 3 by 4 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Program Construction Manager.
3. Include the following information for processing and recording action taken:
a. Project name.
b. Date.
c. Name of Program Construction Manager.
d. Name of Contractor.

e. Name of Subcontractor.
f. Name of supplier.
g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.
1) Submittal number shall use Specification Section number followed by decimal point and then sequential number (e.g., 06 1000.01). Resubmittals shall include alphabetic suffix after another decimal point (e.g., 06 1000.01.A).
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. Other necessary identification.

4. Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Program Construction Manager observes noncompliance with provisions in Contract Documents, initial submittal may serve as final submittal.
a. Submit one (1) copy of submittal to concurrent reviewer in addition to specified number of copies to Program Construction Manager.

5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form. Architect or Program Construction Manager will discard submittals received from sources other than Contractor.
a. Transmittal Form for Submittals: Provide locations on form for the following information:
1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name of Program Construction Manager.
6) Name of Contractor.
7) Names of Subcontractor, manufacturer, and supplier.
8) Category and type of submittal.
9) Submittal purpose and description.
10) Specification Section number and title.
11) Specification paragraph number or drawing designation and generic name for each of multiple items.
12) Drawing number and detail references, as appropriate.
13) Transmittal number, numbered consecutively.
14) Submittal and transmittal distribution record.
15) Remarks.
16) Signature of transmitter.

E. Deviations and Additional Information: On attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Program Construction Manager on previous submittals, and deviations from requirements in Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Program Construction Manager's action stamp.

G. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Program Construction Manager's action stamp.

1.6 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Provide all shop drawings and product data for Approval electronically unless hard copy prior approval has been received from the Construction Manager. All color selection samples will require three (3) sets of physical samples, assuming only one will be required to be returned to the contractor. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Action Submittals: Submit one (1) electronic copy of each submittal unless otherwise indicated. Program Construction Manager will return one (1) electronic copy.
   2. Informational Submittals: Submit one (1) electronic copy of each submittal unless otherwise indicated. Program Construction Manager will not return copies.
   3. Web-Based Project Management Software: If web based project management software is used prepare submittals in PDF form, and upload to the software website. Enter required data in web-based software site to fully identify submittal.
   4. Certificates and Certifications Submittals: Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into 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 written recommendations.
      b. Manufacturer's installation instructions.
      c. Manufacturer's catalog cuts.
      d. Manufacturer's product specifications.
      e. Standard color charts.
      f. Statement of compliance with specified referenced standards.
      g. Testing by recognized testing agency.
      h. Application of testing agency labels and seals.
      i. Notation of coordination requirements.
      j. Availability and delivery time information.
      k. Mill reports.
      l. Standard product operation and maintenance manuals.
   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 one electronic copy of product data unless otherwise indicated. Program Construction Manager will return one (1) electronic copy.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base shop drawings on reproductions of Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in Contract Documents. Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Schedules.
   d. Compliance with specified standards.
   e. Notation of coordination requirements.
   f. Notation of dimensions established by field measurement.
   g. Relationship and attachment to adjoining construction clearly indicated.
   h. Seal and signature of professional engineer if specified.
   i. Fabrication and installation drawings.
   j. Roughing-in and setting diagrams.
   k. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   l. Shop work manufacturing instructions.
   m. Templates and patterns.
   n. Design calculations.
   o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
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, but no larger than 24 by 36 inches.
3. Submit shop drawings in the following format:
   a. One (1) electronic copy of each submittal. Program Construction Manager will return one (1) electronic copy.

D. Samples: Submit samples for review of kind, color, pattern, and texture for check of these characteristics with other elements and for 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 (1) 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.
   e. Specification paragraph number and generic name of each item.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout 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 Work are indicated in individual Specification Sections. Such samples must be in undamaged condition at time of use.
   b. Samples not incorporated into Work, or otherwise designated as Owner's property, are property of Contractor.
4. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for 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 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 (3) sets of Samples. Program Construction Manager will retain two (2) Sample sets; remainder will be returned.
      1) Submit 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 Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare written summary indicating types of products required for work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in Contract Documents or assigned by Contractor if none is indicated.
   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 one electronic copy of product schedule or list unless otherwise indicated. Program Construction Manager will return one (1) copy.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01.

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of welding procedure specification and procedure qualification record on AWS forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by qualified testing agency, or on comprehensive tests performed by qualified testing agency.

R. Research Reports: Submit written evidence, from model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Preconstruction Test Reports: Submit reports written by qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

1.7 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by design professional are specifically required of Contractor by Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to shop drawings, product data, and other required submittals, submit one electronic copy of certificate, signed and sealed by responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by design professional.
1. Indicate that products and systems comply with performance and design criteria in Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of Contract and for compliance with Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Program Construction Manager.
   1. Submittals that do not bear Contractor's approval stamp will be returned without action by Architect and Program Construction Manager.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with 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 Contract Documents.

1.9 PROGRAM CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Program Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Program Construction Manager will stamp each submittal with action stamp and will mark stamp appropriately to indicate action.
   1. Stamp will indicate that submittal is in general conformance with Contract Documents, except as noted below stamp.
   2. Marking or notes shall not be construed as relieving the Contractor from compliance with the project plans and specifications. The Contractor remains responsible for details and accuracy, for conforming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly and installation, and for performing Work in a safe manner.

B. Informational Submittals: Architect and Program Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Program Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for portion of Work will be reviewed when use of partial submittals has received prior approval from Architect and Program Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by Contract Documents may be returned by Program Construction Manager without action.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 013300

SECTION 013333 – ELECTRONIC DRAWINGS

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. The Architect/Engineer, if requested, will provide the Contractor with one electronic copy of the Contract Document Drawings for distribution to subcontractors and suppliers. The electronic copy will be provided in AutoCAD 2007BIM.

B. The Architect shall be paid a service fee. Contact Architect if fee applies and if requested by the Contractor in accordance with the Agreement. Electronic files of these sheets will be released upon receipt of payment.

1.3 REFERENCES

A. A copy of the AIA Document C106-2022 Digital Licensing Agreement is included at the end of the Section.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 01333a

DRAFT

AIA® Document C106™ – 2022

Digital Data Licensing Agreement

AGREEMENT made as of the _____ day of _____ in the year 20_____

BETWEEN the Party transmitting Digital Data ("Transmitting Party")

« »
« »
« »
« »
« »

and the Party receiving the Digital Data ("Receiving Party"):
(Name, address, and contact information, including electronic addresses)

« »
« »
« »
« »
« »

for the following Project:
(Name and location or address of the Project)

« Clinton-Graceville Beardsley Schools, 2025 Addition & Renovations »
« 712 East 3rd Street, Graceville, MN 56240 »

for the following Digital Data ("Digital Data"):
(Identify below, in detail, the information created or stored in digital form that the Parties intend to be subject to this Agreement.)

« »

The Transmitting Party and Receiving Party agree as follows.

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

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

TABLE OF ARTICLES

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 The purpose of this Agreement is to grant a license from the Transmitting Party to the Receiving Party for the Receiving Party's use of Digital Data and to set forth the license terms.

§ 1.2 This Agreement is the entire and integrated agreement between the Parties. Except as specifically set forth herein, this Agreement does not create any other contractual relationship between the Parties.

§ 1.3 Digital Data is defined as information, communications, drawings, or design created or stored for the Project in digital form. DIGITAL DATA includes but is not limited to CAD/BIM files. Confidential Digital Data is Digital

Data containing confidential or business proprietary information that the Transmitting Party designates as "confidential."

ARTICLE 2 TRANSMISSION OF DIGITAL DATA

§ 2.1 The Transmitting Party grants to the Receiving Party a nonexclusive limited license to use the Digital Data solely and exclusively for the uses, and in accordance with the terms, set forth in Article 3.

§ 2.2 Only the Receiving Party is permitted to access and use the Digital Data. Unlicensed and unauthorized access or use by third parties is strictly prohibited except as set forth in Section 2.4.1.

§ 2.3 The transmission of Digital Data constitutes a warranty by the Transmitting Party to the Receiving Party that the Transmitting Party is the copyright owner of the Digital Data or otherwise has permission to transmit the Digital Data to the Receiving Party for its use on the Project in accordance with the terms and conditions of this Agreement.

§ 2.4 Where the Transmitting Party has designated information furnished pursuant to this Agreement as "confidential," the Receiving Party shall keep the information confidential and shall not disclose it to any other person or entity except as set forth in Section 2.4.1.

§ 2.4.1 The Receiving Party may disclose Confidential Digital Data after seven (7) days' notice to the Transmitting Party 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 Receiving Party may also disclose Confidential Digital Data 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.

§ 2.5 By transmitting Digital Data, the Transmitting Party does not convey any ownership right in the Digital Data or in the software used to generate the Digital Data. Unless otherwise granted in a separate license, the Receiving Party's right to use, modify, or further transmit Digital Data is specifically limited to those uses, and in accordance with the terms, set forth in Article 3, and nothing contained in this Agreement conveys any other right to use the Digital Data.

§ 2.6 To the fullest extent permitted by law, the Receiving Party shall indemnify and defend the Transmitting Party from and against all claims arising from or related to the Receiving Party's modification to, or unlicensed use of, the Digital Data.

§ 2.7 Transmission of the Digital Data does not abridge or extinguish the Transmitting Party's rights, including, to the extent applicable, exclusive ownership interest, in such information under all applicable state, federal, and international laws including, without limitation, laws governing the protection of copyrights and intellectual property.

§ 2.8 The provisions of this Article 2 shall survive the termination of this Agreement.

ARTICLE 3 LICENSE CONDITIONS

§ 3.1 The Receiving Party may use and rely upon the Digital Data to the extent set forth in this Article 3. *(Choose only one option below.)*

> **§ 3.1.1** The Digital Data is transmitted solely for the Receiving Party's information. Receiving Party acknowledges that any use of the Digital Data shall be at Receiving Party's sole risk. The Receiving Party accepts the Digital Data "as is" without any warranty or representations from the Transmitting Party as to whether the Digital Data is accurate, complete, or fit for use as intended by the Receiving Party. The Receiving Party is solely responsible for verifying whether the Digital Data is accurate, complete, or fit for the Receiving Party's intended use.

«Transmitting Party makes no representation as to the compatibility of the CAD/BIM files with any hardware or software.

Transmitting Party makes no representation regarding the accuracy, completeness, or permanence of CAD/BIM files, nor for their merchantability or fitness for a particular purpose. Addenda information or revisions made after the date indicated on the CAD/BIM files may not have been incorporated. In the Event of a conflict between the Transmitting Party's sealed Contract Drawings and CAD/BIM files, the sealed Contract Drawings shall govern. It is the OCT's responsibility to determine if any conflicts exist. The CAD/BIM files shall not be considered to be Contract Documents as defined by the General Conditions of the Contract for Construction.

The use of CAD/BIM files prepared by the Transmitting Party shall not in any way obviate the Receiving Party's responsibility for the proper checking and coordination of dimensions, details, member sizes and gage, and quantities of materials as required to facilitate complete and accurate fabrication erection.

The laws of the State in which the Project is located shall govern this Agreement. »

§ 3.2 If no specific terms or uses are selected or set forth in Section 3.1, then the Receiving Party may use the Digital Data at its sole risk pursuant to the terms and conditions set forth in Section 3.1.1.

ARTICLE 4 LICENSING FEE OR OTHER COMPENSATION

The Receiving Party agrees to pay the Transmitting Party the following fee or other compensation for the Receiving Party's use of the Digital Data:
(State the fee, in dollars, or other method by which the Receiving Party will compensate the Transmitting Party for the Receiving Party's use of the Digital Data.)

«The Transmitting Party will provide the Digital Data, dated _____, for the following drawings:

_____ _____

_____ _____

_____ _____

_____ _____

Drawings were prepared on the following:

Computer Software: _____ / Version:_____

The Receiving Party shall ppay the Transmitting Party as indicated in Section 013333 "Electronic Drawings. »

This Agreement is entered into as of the day and year first written above and terminates one year from said date, except as set forth below.
(Indicate when this Agreement will terminate, if other than one year from the date it was entered into, and other conditions related to termination.)

« »

TRANSMITTING PARTY *(Signature)*	**RECEIVING PARTY** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

END OF SECTION 013333b

SECTION 013500 - SAFETY

PART 1 - GENERAL

1.1 SUMMARY

A. It is recognized that the safety of all personnel is the responsibility of all participants involved directly in the construction of this Project. It is the contractual obligation of each Contractor to adhere to all requirements of the Occupational Health and Safety Act (OSHA), as well as Local and State safety rules and regulations. Each Contractor shall assure the safety of his personnel by providing all protection and safety devices, covers, etc. as they relate to the safe conduct of his work in accordance with all Local, State and Federal regulations. Each Contractor is responsible for any safety requirements that are contractually those of any Contractor.

B. The Lead Safety Contractor designated in Section 002413 "Scopes of Bid" shall be the "Lead Safety Contractor" and "Competent Person" with respect to jobsite safety. This responsibility shall be fulfilled by a full-time on-site representative. Responsibilities and authority of the "Lead Safety Contractor" shall be as follows:

1. The Lead Safety Contractor will be responsible for the overall safety management on the job site. This Contractor is responsible for executing the following activities:
    a. Collect and review the Safety Programs for all prime contractors to ensure that they are adequate and confirm that they have addressed safety guidelines and requirements.
    b. Conduct a site-specific safety orientation meeting in accordance with the requirements identified in this specification section. The orientation meeting shall review general safety best practices for the proposed scope of work on the project. The meeting shall be conducted prior to the commencement of construction activity. Participation by All contractors and subcontractors is mandatory. Maintain a log of all personnel on the project site that have completed orientation.
    c. Maintain an on-site record of Safety orientation, and visible identification that orientation has been completed (i.e. hard hat stickers).
    d. Provide all necessary OSHA/Safety signage required for the site.
    e. Provide daily surveillance of Contractor work areas for compliance with OSHA requirements.
    f. Develop and invoke procedures for advising Contractors of safety violations and deficiencies.
    g. Initiate corrective action in keeping with this specification section if the prime contractor does not comply with safety violation directives.
    h. **ROOF Safety**: Identify, Provide, Install and Maintain a roof safety program meeting the OSHA standard for work of all contractors. This includes, but is not limited to, a roof perimeter system such as Temporary guard rail, and or flagging from roof access to the work area(s). In the event that a guardrail/flagging system is not physically possible provide appropriate tie off apparatus.
2. Reviewing programs, qualifications, records and practices of all other contractors, suppliers, and personnel on the site is part of this responsibility. Where OSHA requires or where unique/special operations and applications are utilized by any contractor, the Lead Safety Contractor must verify that a Qualified Person is

present. The Lead Safety Contractor must conduct monthly Safety Meetings utilizing all contractor safety representatives. Additionally, each Contractor will assure that every employee and their subcontractors on the job site have received an orientation to the Safety Requirements and Policies for this specific site. This orientation must be documented, and proof of the orientation must be forwarded to both the Lead Safety Contractor, the Program Construction Manager, and Owner.

3. The "Lead Safety Contractor" will maintain a "Competent Person" with a minimum of a 30 Hour OSHA Certification full time on site. This person's responsibility is to review the daily operations for all contractors, suppliers, visitors, and personnel as it pertains to safety. Daily safety walkthroughs are required. This person will be the initial person to serve as the designated site representative during an OSHA inspection. These duties may be assigned to a more senior safety professional if one is present or within an appropriate response time. The Lead Safety Contractor shall encourage participation of other contractor's "Safety Representatives" during these inspections.
4. Where the work of one (1) Contractor places another contractor's workers, suppliers, or subcontractors in jeopardy, the "Lead Safety Contractor" shall direct and coordinate the effort of the contractors, suppliers, and personnel to ensure immediate abatement.
5. Each Prime Contractors will maintain primary responsibility for the safety of their own workers and subcontractors, if utilized. The "Lead Safety Contractor" will assist in identifying areas of concern and will endeavor to accomplish required corrections through cooperation of other Prime Contractors and all others involved as necessary. In the event this effort is unsuccessful, the "Lead Safety Contractor" will take action to correct.
6. The Lead Safety Contractor shall provide regular and periodic safety inspections and reports by a safety professional with a minimum of a 30 Hour OSHA Certification. Inspections and reports shall be performed at least once each month and will include a review of all OSHA requirements for the entire site, including all Prime Contractors and subcontractor work, tools, equipment, and safety practices. A written report must be generated and distributed to all Prime Contractors within three (3) days of the safety inspection. Any safety violations noted within the report will be corrected immediately by the responsible party. If not corrected within 24 hours of the report being issued, the "Lead Safety Contractor" shall take corrective action. A copy of the report must be forwarded to the Program Construction Manager as proof of performance. If the report is not complete or does not address the entire site and all working conditions, it will be rejected, and a new inspection must be held immediately.
7. The Lead Safety Contractor will provide a separate line item on their Schedule of Values for Safety. Once the monthly report is issued and accepted and other responsibilities are performed, the Lead Safety Contractor can bill against this line item.
8. Each Prime Contractor and subcontractor shall provide a safety representative who is responsible to act as the Competent Person for their company. This person must have at least a 10-hour OSHA Certification**,** a current First Aid and CPR certification, and all specific knowledge and certifications related to any of their functions and employees. For specialty operations or unique practices, a "Qualified Person" must be utilized and must represent the Contractor.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 ACCIDENTS

A. All Contractors shall notify the "Lead Safety Contractor and the Program Construction Manager of any personal injury that could require medical treatment of anyone at the project site. Also, any damage to property arising in connection with the Contractor's performance should be told to the "Lead Safety Contractor," the Program Construction Manager, and Owner as promptly as possible after the occurrence of such injury or damage. In no event shall any notification occur more than 24 hours after any personal injury described in this Article 3.1. Within 48 hours of such occurrence, the Contractor shall furnish to the Lead Safety Contractor, the Program Construction Manager, and Owner a complete written report of such injury or damage. Accident Reports shall include specific actions taken by Contractor to preclude recurrence of similar incidents.

3.2 EMERGENCY DATA

A. Each Contractor shall provide the Lead Safety Contractor and the Program Construction Manager with the following emergency data prior to beginning work at the project site:
   1. Detailed description of overall corporation or company safety program.
   2. Employees qualified in any type of first aid, list employee and associated skill.
   3. Detailed description of specifically tailored job site safety program.
   4. Identify corporate and job site safety officer.
   5. Submit weekly toolbox safety talk program/meeting minutes including;
      a. Day of week.
      b. Time of day.
      c. Location.
      d. Attendance record.
      e. Agenda.
      f. Unsafe items previously discussed, date of correction.
      g. Identify on site personnel with FIRST AID training.
   6. All applicable SDS Program sheets or on-line access.
   7. Review project "Emergency Response Plan" with Construction Manager.

3.3 SAFETY AGREEMENT

A. Each Prime Contractor and Subcontractor shall review and comply with the following Safety Agreement, items 1 through 4, before beginning work:
   1. As a Contractor on this Project, you have, by accepting the terms of your contract, obligated yourself to conduct all your operations within this Safety Agreement.
   2. The Contractor agrees that the prevention of accidents to employees engaged in the Work under its contract is the responsibility of the Contractor.
   3. When so ordered, the Contractor agrees to stop any part of the Work which the Lead Safety Contractor, Program Construction Manager, Owner, or any other applicable agency may deem unsafe until corrective measures satisfactory to the Lead Safety Contractor and in accordance with the applicable Federal, State, and local regulations have been taken. No Contractor shall have a claim for damages

resulting from or arising out of such stoppages. Should the Contractor neglect to adopt such corrective measures, the Lead Safety Contractor, with written authorization from the Owner and after providing the Contractor an opportunity to cure, may perform the corrections and all costs will be deducted from payments due or to become due the Contractor. Failure on the part of the Lead Safety Contractor to stop unsafe practices shall in no way relieve the Contractor of his responsibility.

3.4 HOUSEKEEPING

A. Indiscriminate accumulations of debris waste or scrap in work areas will not be permitted. (Areas will be designated for storage or disposal.) All materials, tools and equipment must be stored in an orderly manner in designated areas.

3.5 PERSONAL PROTECTION EQUIPMENT

A. Each Contractor must furnish their employees with the proper type of personal protective equipment as required by the operations being performed, including, but not necessarily limited to the following:
   1. Hard Hats must be furnished to employees and worn at all times when on this project, whether or not an overhead hazard exists or what state the project may be in.
   2. Appropriate attire must be worn at all times while employees are working on-site. Appropriate attire includes High Visibility sleeved shirts, long pants, appropriate work boots or shall be in accordance with all applicable OSHA regulations.
   3. Safety glasses must be worn by people at all times while on site. No exceptions.

3.6 SAFETY MEETINGS

A. Each Contractor is required to conduct, and all employees are required to attend, a toolbox type safety meeting at the beginning of each week. The meetings may either be presided over by Contractor's foreman, or another competent representative designated by the Contractor. The Construction Manager's personnel will be allowed to participate in these safety meetings.

3.7 FIRE PROTECTION

A. The Lead Safety Contractor shall provide the required number of Fire Extinguishers to comply with OSHA standards. When necessary, Contractors must supply approved type fire extinguisher for emergency use within their own immediate area of operation, including Hot Work areas, the Contractor's office, tool and storage enclosures.

3.8 TREATMENT OF INJURIES

A. Contractors shall require that all employees injured (no matter how slight) while working on this project, report immediately for First Aid Treatment. The Contractor shall maintain adequate First Aid Facilities in the field.

3.9 COOPERATION

A. Any deviation from this course of action will be called to the attention of the appropriate Contractor for immediate correction. Conversely, any Contractor should call attention to any unsafe conditions or unsafe practice by any other Contractor at the site.

3.10 INSTALLED SAFETY APPARATUS

A. The "Lead Safety Contractor" is responsible for checking and maintaining the roof safety system daily before each shift. The system needs to be in place prior to work commencing on the roof and maintained until all final check-outs and inspections have been completed. Note that the system can be incorporated with the Roofing contractor's system as long as the barriers are maintained at a "non-roofers" distance. The incorporated system will need to be maintained and inspected as mentioned above.

B. Each Contractor is responsible for the reinstallation of safety apparatus installed by other Contractors if removed to facilitate the installation of their own contract work. Each Contractor is to return the safety cables to an OSHA approved condition without slack.

3.11.1 WEAPONS POLICY

A. All persons are prohibited from carrying, possessing or storing a handgun firearm, or weapon of any kind while on the project, regardless of whether the person has registered the weapon or is licensed to carry a concealed weapon.

B. Failure to abide by all terms and conditions of the policy may result in discipline up to and including termination. Further, carrying any weapon onto the Owner's property in violation of this policy will be considered an act of criminal trespass and possession of a weapon will be grounds for immediate removal of the person from the Project Site, and may result in prosecution.

3.12 RADIOS

A. The playing of radios or the use of headsets/ earphones will not be permitted on this project.

3.13 DEFINITIONS

A. The term "Competent Person shall have the same meaning as provided in 29 CFR § 1926.32(f): one who is capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

B. The term "Qualified Person shall have the same meaning as provided in 29 CFR § 1926.32(l): one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

C. The term "Contractor" shall mean any Prime Contractor for the Project and its subcontractors of any tier.

END OF SECTION 013500

SECTION 013513 – SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tax Exempt Status if indicated on the Bid Form.
2. Equal Employment Opportunity Requirements.
3. Personnel Identification.
4. Alcohol, Tobacco, Drug, and Weapon Restrictions.
5. Harassment Policies.
6. Hazardous Material Procedures.
7. Fire Precautions and Protection.
8. Alcohol, Tobacco, Drug, and Weapon Restrictions.
9. Written Infectious Disease Plan.
10. Supply Chain.

1.2 TAX EXEMPT STATUS (IF INDICATED ON THE BID FORM)

A. Owner has tax exempt status in the State of Minnesota and will require Contractor and Subcontractors to complete an agreement to be authorized purchasing agents of Owner if break out is indicated on Bid Form. Owner will provide tax exemption documentation and forms to establish Contractor and Subcontractors as its purchasing agents with award of Contract.

B. To the extent permitted by the law of the State of Minnesota, Owner reserves the right to award Purchasing Agreement Contract to different parties.

C. Contractor and Subcontractors shall comply with the following:
1. Directly purchase materials for Project and maintain a record of invoices of such purchases.
2. Provide a copy of letter and certificate to material suppliers and manufacturers.
3. Take responsibility in maintaining records identifying materials purchased and verifying they were used on Project.

1.3 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS

A. As a condition of being awarded Contract for Work, each Contractor shall:
1. Not discriminate against employees or applicants for employment because of race, color, religion, sex, or national origin.
2. Take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, the following:
a. Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.
3. State, in solicitations or advertisements for employees placed by or on behalf of Contractor, that qualified applicants will receive consideration for employment without regard to race, creed, color, religion, national origin, sex, age, or physical or mental disability, except where it relates to a bona fide occupational qualification.
4. Send to each labor union or representative of workers with which Contractor has a collective bargaining agreement or other contract or understanding a notice advising labor union or workers' representative of Contractor's commitments under this nondiscrimination clause for posting in conspicuous places available to employees and applicants for employment.

1.4 PERSONNEL IDENTIFICATION

A. Construction Personnel Identification: Program Construction Manager will provide identification tags for Contractor personnel working on Project site if required. Require personnel to use identification tags at all times.
   1. Construction personnel and trades people will be required to fill out an identification form prior to issuance of a badge. Construction personnel and tradespeople not wearing badges will be asked to put on their badge.

B. Employee Screening: If required, comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.5 ALCOHOL, TOBACCO, DRUG, AND WEAPON RESTRICTIONS

A. Entire Project site is designated an alcohol-free, tobacco-free, drug-free, and weapon-free zone. Use of alcohol, tobacco products and other controlled substances, and weapons on Project site and within existing building is not permitted by persons having anything to do with Project.
   1. Review, become familiar with, and enforce Owner’s policies on alcohol, tobacco, drugs, and weapons.
   2. Enforcement of this policy includes removal of such personnel that are not complying with policy requirements.
   3. The term “smoke” includes smoking a cigarette, cigar, or pipe, or carrying a lighted cigarette, cigar, or pipe.
   4. The term “tobacco product” includes chewing of tobacco or snuff or consumption of other tobacco products.
   5. Use of smoke or tobacco cessation products, as long as it does not generate smoke, is prohibited under this policy.

1.6 HARASSMENT POLICY

A. Become familiar with Owner’s non-harassment policies. Workplace violence or harassment will not be tolerated from any person on Project site. Construction personnel and Subcontractors are expected to follow this policy while conducting company business at other locations. Acts of violence or harassment committed by or against any employee is unacceptable and may be subject to discipline policy or other legal action.

1.7 HAZARDOUS MATERIALS PROHIBITION

A. Work Near Asbestos Materials:
   1. During Work of this Project, Contractor may encounter non-scheduled or concealed suspect asbestos containing materials. If, in Contractor’s opinion, the presence of these materials poses a question or hazard to any person in the building, immediately stop Work in the area where the presence of materials poses a question or hazard to any person in the building and immediately notify Program Construction Manager. Program Construction Manager shall immediately notify Owner. Owner shall take appropriate corrective action.
   2. If Contractor disturbs asbestos containing materials, immediately stop Work in affected area, restrict access, and notify Program Construction Manager. Program Construction Manager shall immediately notify Owner. Owner shall take appropriate corrective action. Nothing in this paragraph prohibits Owner from directing Contractor to take corrective action or cause corrective action to be taken.
   3. Unless Contractor causes the release of asbestos containing materials, Owner will employ an asbestos abatement contractor to abate known asbestos.

4. Coordinate, verify, and confirm with Program Construction Manager, Owner, and asbestos abatement contractor known asbestos containing materials for abatement prior to starting Work of this Project.
5. In the event Contractor's acts or omissions cause a release of hazardous materials, including but not limited to the release of asbestos, Owner shall be entitled to back charge or otherwise obtain compensation from any Contractor for all costs associated with the clean-up of the hazardous materials and any project delay damages, including the costs claimed by any other contractor.

B. Use of asbestos or asbestos-containing products is prohibited in Work of this Project or in tools, devices, clothing, or equipment used to affect this Work.
1. Asbestos and asbestos-containing products include items containing chrysotile, crocidolite, amosite, anthophylite, tremolite, and actinolite.
2. Material containing greater than 0.01 percent asbestos is defined as asbestos-containing material.
3. Disputes involving the question of whether or not material installed with asbestos-containing products will be settled by electron microscope. Pay costs of such tests.
4. Architect will immediately reject Work or materials found to contain asbestos, or Work or material installed with asbestos-containing products. Remove rejected Work from Project site at no additional cost to Owner.

C. Use of wood preservatives containing inorganic arsenals, creosote, and pentachlorophenol are strictly prohibited unless precautionary labeling approved by Environmental Protection Agency (EPA) per the September 30, 1985 Settlement Agreement with the Wood Industry Consortium is affixed and precautions labeled are followed exactly. After sawing and working with treated wood, collect and dispose sawdust and debris off Project site in a manner approved by EPA.

D. Materials installed in Work that have been prohibited by this Section, or materials installed using installation procedures prohibited by this Section, are deemed to be defective and non-conforming as defined in Section 007200 "General Conditions of the Contract for Construction," AIA Document A232-2019.

1.8 FIRE PRECAUTIONS AND PROTECTION

A. Take necessary precautions to guard against and eliminate possible fire hazards per fire protection and prevention laws and codes, and to prevent damage to construction Work, building materials, equipment, temporary field offices, storage sheds, and other property, both public and private. Conspicuously post locations of nearest fire alarm box and telephone number of local fire department throughout field offices and in building structure adjacent to its Work.

B. Do not allow fires to be started with gasoline, kerosene, or other highly flammable materials. No open fires are permitted.

C. Welding, flame cutting, or other operations involving the use of flame, arcs, or sparking devices will not be allowed without adequate protection and shielding, particularly at point of operation. Remove combustible and flammable material from immediate working area. If removal is impossible, protect flammable or combustible materials with a fire blanket or suitable non-combustible shield to prevent spark, flames, or hot metal from reaching flammable or combustible materials.

D. Provide necessary personnel and firefighting equipment to efficiently control incipient fires resulting from welding, flame cutting, or other operations involving use of flame, arc, or sparking devices.

E. Flammable Materials: Do not bring more than one (1) day supply of flammable liquids such as oil, gasoline, paint, or paint solvent into building at any time. Confine flammable liquids having a flash point of one hundred and ten (110) degrees Fahrenheit or below, which must be brought into Project site, to UL

labeled safety cans. Detach bulk supply of flammable liquids at least seventy-five (75) feet from buildings and from yard storage of building materials.

F. Do not store combustible materials, or leave overnight, within confines of permanent buildings. This includes internal combustible engines using gas or fuel oil.

G. Provide ABC fire extinguishers in such numbers and sizes as to satisfy OSHA rules and regulations, and other applicable standards.

1.9 ALCOHOL, TOBACCO, DRUG, AND WEAPON RESTRICTIONS

A. Entire Project site is designated an alcohol-free, tobacco-free, drug-free, and weapon-free zone. No smoking will be allowed on site by any person having anything to do with Project. Enforce good order among personnel and Subcontractors with regard to State Statutes.

1.10 WRITTEN INFECTIOUS DISEASE SAFETY PLAN

A. Contractor shall provide a written infectious disease safety plan for the job site.

1.11 SUPPLY CHAIN

A. Contractor shall notify Program Construction Manager as soon as Contractor believes it has an actual delay in any part of its supply chain that will affect its ability to maintain the schedule on the Project.

B. Contractor shall notify Program Construction Manager if it learns that its supplier's current inventory levels are unable to support three (3) to six (6) month supply chain disruption.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 013513

SECTION 013516 – ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special procedures for Alteration Work.

1.3 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, Repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's Prebid selection of work to be Matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to Match original, or as otherwise indicated.

G. Repair: To correct damage and defects, Retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To Reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or Dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of Alteration Work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for Alteration Work.
   1. Schedule construction operations in sequence required to obtain best Work results.
   2. Coordinate sequence of Alteration Work activities to accommodate the following:
      a. Owner's continuing occupancy of portions of existing building.
      b. Owner's partial occupancy of completed Work.
      c. Other known work in progress.
      d. Tests and inspections.
   3. Detail sequence of Alteration Work with start and end dates.
   4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
   5. Use of elevator and stairs.
   6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate Alteration Work with circulation patterns within Project building(s) and site. Some work is near circulation patterns. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

A. Refer to Section 013100 "Project Management and Coordination," Article 1.8.

1.6 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
   1. Carefully Dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at the Project site.

1.7 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:
   1. Submit Alteration Work subschedule within thirty (30) days of date established for notice to proceed.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's Alteration Work operations.

C. Alteration Work Program: Submit thirty (30) days before work begins.

D. Fire-Prevention Plan: Submit thirty (30) days before work begins.

1.8 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to Alteration Work as specified in each Section and that has completed a minimum of five (5) recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
   1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
      a. Construct new mockups of required work whenever a supervisor is Replaced.

B. Alteration Work Program: Prepare a written plan for Alteration Work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project Alteration Work program with specific requirements of programs required in other Alteration Work Sections.
   1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
   2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6 and any site specific safety plans put in place by the Contractor or Program Construction Manager.

1.9 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:
   1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
   2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
   3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:
1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and Repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be Dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

E. Storage Space:
1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space does not include security for stored material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.10 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs and preconstruction videotapes.

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by twelve (12) inches or more.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from Alteration Work.
   1. Use only proven protection methods, appropriate to each area and surface being protected.
   2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where Alteration Work is being performed.
   3. Erect temporary barriers to form and maintain fire-egress routes.
   4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during Alteration Work.
   5. Contain dust and debris generated by Alteration Work and prevent it from reaching the public or adjacent surfaces.
   6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
   7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
   8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:
   1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
   2. Do not attach temporary protection to existing surfaces except as indicated as part of the Alteration Work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:
   1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by Alteration Work before commencing operations.
   2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for Alteration Work.
   3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from Alteration Work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection as indicated on Drawings.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:
1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
1. Obtain Program Construction Manager's approval for operations involving use of welding or other high-heat equipment. Notify Program Construction Manager at least twenty-four (24) hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than thirty (30) minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
    e. Maintain fire-watch personnel at each area of Project site until sixty (60) minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
   1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in Alteration Work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings.

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
   1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect or Program Construction Manager.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
   1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
   2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for the Contractor to provide quality control services required by the Architect, Construction Manager or Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 RESPONSIBILITIES

A. Contractor Responsibilities: The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Contractor’s responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor.
   1. The Owner shall employ and pay an independent agency, to perform specified quality control services.
   2. Retesting: The Contractor is responsible for retesting costs where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor’s responsibility.
      a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility.
   3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
      a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
      b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
      c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
      d. Security and protection of samples and test equipment at the Project site.

B. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate

with the Construction Manager and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

C. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.3 SUBMITTALS

A. The Construction Manager shall submit a certified written report of each inspection, test or similar service, to the Contractor, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
   a. Date of issue.
   b. Project title and number.
   c. Name, address and telephone number of testing agency.
   d. Dates and locations of samples and tests or inspections.
   e. Names of individuals making the inspection or test.
   f. Designation of the Work and test method.
   g. Identification of product and Specification Section.
   h. Complete inspection or test data.
   i. Test results and an interpretation of test results.
   j. Location of sample or test in project.
   k. Ambient conditions at the time of sample-taking and testing.
   l. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
   m. Name and signature of laboratory inspector.
   n. Recommendations on retesting.

1.4 QUALITY ASSURANCE

A. Qualification for Service Agencies: The Owner will engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

1.5 TRADESMEN & WORKMANSHIP

A. Ensure that tradesmen performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in

the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

1.6 COORDINATION

A. Coordination: The Contractor shall coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

1.7 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for “Cutting and Patching."

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor’s responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

1.8 GENERAL INSTALLATION 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. Manufacturer's Instructions: Comply with manufacturer’s installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

1.9 REPLACEMENT OF WORK

A. Within twenty-four (24) hours after rejection of work pursuant to the General Conditions, remove all materials and equipment so rejected and immediately replace work, at the Contractor's cost, to the satisfaction of the Architect and Construction Manager. Should the work of the Owner or other Contractors be damaged by such removal or replacement, the Contractor shall reimburse the Owner or other Contractors for all costs incurred for correcting damage.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 014000

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in Conditions of the Contract.

B. Addenda: Written and/or graphic instruments issued by Architect prior to execution of Contract that modify or interpret Bidding Documents by additions, deletions, clarifications, or corrections. Addenda become part of Contract Documents when Construction Contract is executed.

C. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in Conditions of the Contract.

D. By Owner (BO): Items that will be ordered, paid for, and shipped to Project by Owner. Contractor shall receive, unload, unpack or uncrate, protect, move into place, install, and connect these items as specified or indicated in Contract Documents.

E. Days: Where number of days are indicated, these mean calendar days and not business days, unless indicated otherwise.

F. Directed: A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

G. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. Herein: Contents of a particular Section, or contents within any or all of parts and sections of Conditions of the Contract (General and Supplementary Conditions) and Division 01 - General Requirements.

I. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have same meaning as "indicated."

J. Install: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

K. Installer: Contractor or another entity engaged by Contractor, either as an employee, Subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in operations in which they are engaged to perform.

L. Not in Contract (NIC): Products not in Contract, but which may require provisions in construction for future installation by others.

M. Project Site: Space available for performing construction activities either exclusively or in conjunction with others performing other Work as part of Project. Extent of Project site is shown on Drawings and may or may not be identical with description of land on which Project is to be built.

N. Provide: Furnish and install, complete and ready for intended use.

O. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within construction industry that control performance of Work.

P. Testing Agencies: Independent entity engaged to perform specific inspections or tests, either at Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

Q. Trades: Using terms such as carpentry is not intended to imply that accredited or unionized individuals of corresponding generic name, such as carpenter, must perform certain construction activities. It also does not imply that requirements specified apply exclusively to tradespeople of corresponding generic name.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless 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 standards in effect as of date of the Contract Documents unless otherwise indicated.
1. For Standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should 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, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S." The information on this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.

25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking/.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.

72. DHI - Door and Hardware Institute; www.dhi.org.
73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.eciaonline.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.
87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.

119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int/home.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHIA - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.
158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.
160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
166. PDI - Plumbing & Drainage Institute; www.pdionline.org.

167. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
168. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
169. RFCI - Resilient Floor Covering Institute; www.rfci.com.
170. RIS - Redwood Inspection Service; www.redwoodinspection.com.
171. SAE - SAE International; www.sae.org.
172. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
173. SDI - Steel Deck Institute; www.sdi.org.
174. SDI - Steel Door Institute; www.steeldoor.org.
175. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
176. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
177. SIA - Security Industry Association; www.siaonline.org.
178. SJI - Steel Joist Institute; www.steeljoist.org.
179. SMA - Screen Manufacturers Association; www.smainfo.org.
180. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
181. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
182. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
183. SPIB - Southern Pine Inspection Bureau; www.spib.org.
184. SPRI - Single Ply Roofing Industry; www.spri.org.
185. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
186. SSINA - Specialty Steel Industry of North America; www.ssina.com.
187. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
188. STI - Steel Tank Institute; www.steeltank.com.
189. SWI - Steel Window Institute; www.steelwindows.com.
190. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
191. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
192. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
193. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
194. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
195. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
196. TMS - The Masonry Society; www.masonrysociety.org.
197. TPI - Truss Plate Institute; www.tpinst.org.
198. TPI - Turfgrass Producers International; www.turfgrasssod.org.
199. TRI - Tile Roofing Institute; www.tileroofing.org.
200. UL - Underwriters Laboratories Inc.; www.ul.com.
201. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
202. USAV - USA Volleyball; www.usavolleyball.org.
203. USGBC - U.S. Green Building Council; www.usgbc.org.
204. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
205. WA - Wallcoverings Association; www.wallcoverings.org.
206. WASTEC - Waste Equipment Technology Association; www.wastec.org.
207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
210. WI - Woodwork Institute; www.wicnet.org.
211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.

2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
5. Local State Building Codes – reference codes as applicable.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

9. ADAAAG American Disabilities Act ADA
   Accessibility Guidelines for Buildings and Facilities available from US Access Board www.access-board.gov

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

END OF SECTION 014200

Structural Testing and Special Inspection
Statement of Special Inspections

Project Name: CLINTON-GRACEVILLE-BEARDSLEY SCHOOLS - 2025 ADDITION & RENOVATIONS

Location: Graceville, MN

Owner: CGB Shools District

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the 2018 International Building Code as adopted by the current Minnesota State Building Code. It includes a schedule of Special Inspection services applicable to this project and the identity of agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompasses the following disciplines:

X Structural ☐ Architectural ☐ Other: _____

The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Building Official, the Architect and Structural Engineer of Record. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official, the Architect and SER. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official the Architect and SER.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

ACKNOWLEDGEMENTS

Each appropriate representative shall sign below:

Owner: _____	Firm: _____	Date: _____
Contractor: _____	Firm: _____	Date: _____
Architect: _____	Firm: _____	Date: 12/18/2024
SER: _____	Firm: Albertson Engineering Inc.	Date: 12/18/2024
SI-S: _____	Firm: _____	Date: _____
SI-T: _____	Firm: _____	Date: _____
TA: _____	Firm: _____	Date: _____
F: _____	Firm: _____	Date: _____

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified.

Legend: SER = Structural Engineer of Record; SI-S = Special Inspector - Structural; SI-T = Special Inspector - Technical; F = Fabricator; TA = Testing Agency

Accepted for the Building Department By: _____ Date: _____

Structural Testing and Special Inspection
Program Summary Schedule

Project Name: Clinton-Graceville-Beardsley Schools – 2024 Phase I Addition

Project No.2024-004
Location: Graceville, MN

Permit No. _____(1)

Technical (2)		Description (3)	Type of Inspector (4)	Report Frequency (5)	Assigned Firm (6)
Section	Article				
1705.6	Soils	Required Verification and Inspection of Soils.	SI-T	See Sheet S0.3	
1705.3	Concrete	Required Verification & Inspection of Concrete Construction.	SI-T	See Sheet S0.3	
1705.2.1	Structural Steel	Required Verification and Inspection of Steel Construction.	SI-T	See Sheet S0.3	
TMS 602-16	Masonry	Minimum Verification and Special Inspection Requirements	SI-T	See Sheet S0.4	
1705.2.3	Steel Joists	Required Special Inspections of Open-Web Steel Joists and Joist Girders	SI-T	See Sheet S0.3	
SDI Table 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, and 1.8	Steel Deck	Standard for Quality Control and Quality Assurance for the Installation of Steel Deck	SI-T	See Sheet S0.3	

Notes: This schedule shall be filled out and included in the Structural Testing and Special Inspection Program.

(1) Permit No. to be provided by the Building Official.
(2) Referenced to the specific technical scope section in the program.
(3) Use descriptions per IBC Section 1705, as adopted by Minnesota State Building Code.
(4) Special Inspector - Technical, Special Inspector – Structural, Testing Agency.
(5) Weekly, monthly, per test/inspection, per floor, etc.
(6) Firm contracted to perform services.

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

A. Permanent Enclosure: Permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and openings are closed with permanent construction or substantial temporary closures as determined by Program Construction Manager.

1.3 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

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

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content

D. Fire-Safety Program: Show compliance with requirements of NFPA 241, all relevant laws of the State of Minnesota, and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
   1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
   2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show

procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

3. Indicate methods to be used to avoid trapping water in finished work.

F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste-handling procedures.
   5. Other dust-control measures.

G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
   1. Methods used to meet the goals and requirements of the Owner.
   2. Concrete cutting method(s) to be used.
   3. Location of construction devices on the site.
   4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
   5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
   6. Indicate locations of sensitive [insert research, patient, equipment] areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8 inch OD line posts and 2-7/8 inch OD corner and pull posts, with 1-5/8 inch OD top and bottom rails. Provide galvanized steel bases for supporting posts.

B. Gypsum Wallboard: ASTM C1396; gypsum core wall panel surfaced with 100 percent recycled content paper on front, back and long edges

1. Thickness: 1/2 inch thick by 48 inch wide by maximum available lengths.
2. Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Lumber and Plywood: Comply with requirements as outlined in Section 061000 "Rough Carpentry."

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

F. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches

2.2 TEMPORARY FACILITIES

A. Field Office: Provided by Program Construction Manager.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITES GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Coordinate with Program Construction Manager to locate facilities where they will serve Project adequately and result in minimum interference with performance of Work. Relocate and modify facilities as required by progress of Work.

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

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Program Construction Manager, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use. Damage to these facilities shall be paid by Contractor or evenly distributed among trades on site at time of damage. Once damage has been done, Owner reserves the right to disallow use of existing toilet facilities and require trades to use external portable toilets.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Connect to Owner's existing electric power service as directed by Owner and Program Construction Manager. Maintain equipment in a condition acceptable to Owner
   1. Install electrical power service overhead unless otherwise indicated.
   2. Provide temporary power with required ground fault circuit interrupters (GFCI).
   3. Should existing electrical service be interrupted for service upgrade, provide required temporary service sized to accommodate construction activities.
   4. Temporary power includes power to Program Construction Managers field office if utilized at the site.

H. Lighting: Provide temporary lighting with local switching that provides illumination per OSHA standards for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills safety, security, and protection requirements without operating entire system. This is to include Exit Signs and Emergency illumination were needed, if necessary, for Owner’s occupants’ safe egress if emergency egress needs to be maintained for the owner in the construction area until final occupancy is granted.

I. Life Safety: Life Safety systems including Fire Alarm, Fire Protection, Security Systems, Emergency Lighting, egress doors and pathways are to be maintained during construction will owner is occupying the building if required by the authority having jurisdiction.

J. Telephone Service: Use of Owner's existing telephone system will be allowed for Contractor's communication and faxing correspondence to Contractor's offices only as it pertains to Project Work.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. If required, provide noncombustible construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with ASTM E36 and NFPA 241.
   2. Maintain support facilities until Program Construction Manager schedules Substantial Completion inspection or as directed. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Roads and Paved Areas: Maintain roads and paved areas adequate for construction operations as indicated on Drawings.
   1. If required, provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
   3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
   4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Plant Mixed Asphalt Pavement."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

F. Storage and Staging: Use designated areas of Project site for storage and staging needs.

G. Dewatering: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to provide safe and accessible areas for Work area.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.

   3. Maintain and touch up signs, so they are legible at all times.

I. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

J. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
   1. Place minimum 2 by 12 lumber under dumpster wheels and other objects that may cause damage to existing site surfaces.
   2. Repair damage to existing site surface caused by waste collection to Owner's satisfaction.

K. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

L. Elevator Use: Use of Owner's elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
   1. Do not load elevators beyond their rated weight capacity.
   2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator installer to restore damaged Work so no evidence remains of correction Work. Return items that cannot be refinished in field to shop, make required repairs and refinish entire unit, or provide new units as required.

M. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

N. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction Work.

O. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties to condition as it existed prior to damage as determined and approved by Owner or Owner’s representative.
   1. Where damage to public roads and driveways occurs, make satisfactory and acceptable arrangements with Program Construction Manager, or agency or authority having jurisdiction, for damaged property or facilities concerning its repair or replacement or payment of costs incurred in connection with said damage.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, per.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. Storm water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

H. Site Enclosure Fence: If required and indicated on Drawings, before construction operations begin, provide site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one (1) set of keys to Owner.

I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each Work day.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

L. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of the State of Minnesota and requirements indicated on Drawings.
   1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
   2. Paint and maintain appearance of walkway for duration of the Work.

M. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and Permanent Enclosure is incomplete, insulate temporary enclosures.

N. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
   2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
   3. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
   4. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
   5. Insulate partitions to control noise transmission to occupied areas.
   6. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   7. Protect air-handling equipment.
   8. Provide walk-off mats at each entrance through temporary partition.

O. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas. Each Contractor shell become familiar with and recognize Owner’s no smoking and no tobacco requirements on Owner’s property. Each Contractor’s foreman or superintendent is responsible for enforcing this policy up to and including removal of such personnel that are not complying.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition per requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace, or clean stored or installed material that begins to grow mold.
   7. Perform Work in a sequence that allows any wet materials adequate time to dry before enclosing material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of building enclosure but prior to full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during course of construction and remain wet for 48 hours are considered defective.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a 48-hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a twenty-four (24) hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant

materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Administrative and procedural requirements for selecting Products for use in Project.
2. Product delivery, storage, and handling.
3. Manufacturers' standard warranties on Products.
4. Special warranties.
5. Comparable Products.

1.2 DEFINITIONS

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

B. Basis-of-Design Product Specification: Specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable Products of additional manufacturers named in Specification.
1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable Products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of Products for purposes of evaluating comparable Products**.**

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide Products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Article 2.2 "Comparable Products."

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two (2) or more Products for use on Project, select product compatible with Products previously selected, even if previously selected Products were also options.
   1. Contractor is responsible for providing Products and construction methods compatible with Products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible Products, Architect will determine which Products shall be used.
   3. Contractor and Architect agree to defend, indemnify, and hold Program Construction Manager harmless with respect to any disputes arising under this Section.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of Products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.
   3. See individual identification Sections in all Divisions for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable Products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle Products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver Products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect Products on delivery to determine compliance with Contract Documents and to determine that Products are undamaged and properly protected.

C. Storage:
1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store Products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store Products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored Products from damage and liquids from freezing.
8. Provide secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

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

B. Special Warranties: Prepare written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with Specifications, prepare written document using indicated form properly executed.
3. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide Products that comply with Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide Products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom Products or nonstandard options are specified, provide standard Products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to Products with warranties not in conflict with requirements of Contract Documents.
4. Where Products are accompanied by the term "as selected," Architect will make selection.

5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of Products.
6. Or Equal: For Products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," or "or approved substitution," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    a. Submit additional documentation required by Architect through Program Construction Manager in order to establish equivalency of proposed Products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide named product that complies with requirements. Comparable Products or substitutions for Contractor's convenience will not be considered.
    a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by named manufacturer or source that complies with requirements. Comparable Products or substitutions for Contractor's convenience will not be considered.
    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide Products by the following."

3. Products:
    a. Restricted List: Where Specifications include a list of names of both manufacturers and Products, provide one (1) of Products listed that complies with requirements. Comparable Products or substitutions for Contractor's convenience will not be considered, unless otherwise indicated. Limited list of Products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and Products, provide one (1) of the Products listed, or an unnamed product, that complies with requirements. Comply with requirements in Article 2.2 "Comparable Products" for consideration of an unnamed product. Non-limited list of Products is indicated by the phrase "Subject to compliance with requirements, available Products that may be incorporated in the Work include, but are not limited to, the following." Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

4. Manufacturers:
    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one (1) of the manufacturers listed that complies with requirements. Comparable Products or substitutions for Contractor's convenience will not be considered, unless otherwise indicated. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide Products by one of the following."
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one (1) of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in Article 2.2 "Comparable Products" for consideration of an unnamed manufacturer's product. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose Products may be incorporated in the Work include, but are not limited to, the following." Provision of Products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on product named. Comply with requirements in Article 2.2 "Comparable Products" for consideration of an unnamed product by one (1) of the other named manufacturers. For approval of Products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Program Construction Manager will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers Owner substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Evidence that proposed product does not require revisions to Contract Documents, that it is consistent with Contract Documents and will produce indicated results, and that it is compatible with, and has been coordinated with, other portions of Work.
3. Detailed comparison of significant qualities of proposed product with those named in Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
4. Evidence that proposed product provides specified warranty.
5. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
6. Substitution request is fully documented and properly submitted.
7. Requested substitution will not adversely affect Contractor's Construction Schedule.
8. Requested substitution has received necessary approvals of authorities having jurisdiction.
9. Samples, if requested, will be submitted to Program Construction Manager for final review.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION

NOT USED

END OF SECTION 016000

SECTION 017300 – EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General administrative and procedural requirements governing execution of Work including the following:
      a. Construction layout.
      b. Field engineering and surveying.
      c. Installation of Work.
      d. Cutting and Patching.
      e. Coordination of Owner-installed products.
      f. Progress cleaning.
      g. Starting and adjusting.
      h. Protection of installed construction.
      i. Correction of Work.

1.2 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 construction to original conditions after installation of other Work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site
   1. Prior to commencing work requiring Cutting and Patching, review extent of Cutting and Patching anticipated and examine procedures for ensuring satisfactory result from Cutting and Patching work. Inform Program Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with Cutting and Patching to attend, including the following:
      a. Contractor's superintendent.
      b. Trade supervisor responsible for Cutting operations.
      c. Trade supervisor(s) responsible for Patching of each type of substrate.
      d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by Cutting and Patching operations.
   2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at project site
   1. Prior to commencing work requiring Cutting and Patching, review extent of Cutting and Patching building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Program Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
      a. Contractor's superintendent.
      b. Professional surveyor or Professional engineer responsible for performing Project surveying and layout.
      c. Professional surveyor or Professional engineer responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certified Surveys: Submit two (2) copies signed by land surveyor or professional engineer.

C. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Plan: Submit plan describing procedures at least ten (10) days prior to time Cutting and Patching will be performed. Include the following information:
1. Extent: Describe reason for and extent of each occurrence of Cutting and Patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for Patching and firms or entities that will perform Patching work.
4. Dates: Indicate when Cutting and Patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that Cutting and Patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
6. Structural Elements: Where Cutting and Patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's/Program Construction Manager’s Approval: Obtain approval of Cutting and Patching proposal before Cutting and Patching. Approval does not waive right to later require removal and replacement of unsatisfactory Work.

E. Landfill Receipts: Submit copy of receipts issued by a landfill facility.

1.5 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit two (2) copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

A. Land Surveyor Qualifications: Professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of kind indicated.

B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on Cutting and Patching of construction elements. Before proceeding, meet at Work 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 conflict before proceeding.

1. Structural Elements: When Cutting and Patching structural elements, notify Construction Manager of locations and details of Cutting and await directions from Construction Manager before proceeding. Shore, brace, and support structural elements during Cutting and Patching. Do not cut and patch structural elements in manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.
    l. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in 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. Other construction elements include the following:
    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in manner that results in visual evidence of Cutting and Patching. Do not cut and patch exposed construction in manner that would, in Architect's/Program Construction Manager’s opinion, reduce building's aesthetic qualities. Remove and replace construction that has been cut and patched in visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

1.7 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

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for Patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide match acceptable to Architect for visual and functional performance of in-place materials.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: Existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existence and location of underground utilities, mechanical and electrical systems, and other construction affecting Work.
   1. Before construction, verify location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for Work related to Project that must be performed by public utilities serving Project site.
   3. To the extent Existing Conditions differ from the those indicated in the Contract Documents, immediately notify the Architect and Project Construction Manager consistent with Section 007200 "General Conditions of the Contract for Construction," sections 3.2.2 and 3.7.6.

B. Examination and Acceptance of Conditions: Before proceeding with each component of Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where written report listing conditions detrimental to performance of Work is required by other Sections, include the following:
   1. Description of Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit Work properly. Recheck measurements before installing each product. Where portions of Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of Contract Documents caused by differing field conditions outside control of Contractor, submit request for information to Program Construction Manager per requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out Work, verify layout information shown on drawings, in relation to property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Program Construction Manager promptly.

B. General: Engage land surveyor to lay out Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check location, level and plumb, of every major element as Work progresses.
6. Notify Architect and Program Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with error of closure equal to or less than standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two (2) or more locations.

E. Record Log: Maintain log of layout control Work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make log available for reference by Architect and Program Construction Manager.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Program Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Program Construction Manager before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate Work and components of Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical Work plumb and make horizontal Work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at time and under conditions that will ensure best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform Cutting and Patching. Proceed with Cutting and Patching at earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or Cutting and Patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during Cutting and Patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during Cutting and Patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate Cutting and Patching per requirements in Section 011100 "Summary of Work."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before Cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using Cutting machine, such as abrasive saw or 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.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that will minimize 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 new space. Provide 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 painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over patch, and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in manner that restores enclosure to weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where Cutting and Patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of Work. Adjust construction schedule based on mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Pre-Installation Meetings: Include Owner's construction personnel at pre-installation meetings covering portions of Work that are to receive Owner's work. Attend pre-installation meetings conducted by Owner's construction personnel if portions of Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Each Contractor shall clean their respective Project site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully. Program Construction Manager may assign cleanup as required as part of each Scope of Bid
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if temperature is expected to rise above eighty (80) degrees Fahrenheit.

3. Contain hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, per regulations.
   a. Use containers intended for holding waste materials of type to be stored.
   b. If Contractor fails to keep Work area clean, expense for cleaning will be deducted from Contract (Sixty-five dollars ($65) per hour per worker, plus rental of equipment and purchase of supplies).

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to level of cleanliness necessary for proper execution of Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of Work, broom-clean or vacuum entire Work area, as appropriate.

D. Installed Work: Keep installed Work clean. Clean installed surfaces per written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "HVAC and Electrical Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. All open ductwork shall be covered with plastic until final connections are made.

D. Piping materials must be kept protected from outdoor elements to reduce amount of rust forming inside of pipe before installation.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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. Salvaging nonhazardous demolition and Construction Waste.
   2. Recycling nonhazardous demolition and Construction Waste.
   3. Disposing of nonhazardous demolition and Construction Waste.

B. Related Requirements:
   1. Section 002413 "Scopes of Bids" for coordination of responsibilities for waste management.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or Construction Waste and subsequent Salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or Construction Waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or Construction Waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or Construction Waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and Construction Waste become property of Contractor.

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

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within thirty (30) days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Qualification Data: For refrigerant recovery technician.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

D. Refrigerant Recovery: Comply with requirements in other Sections for refrigerant recovery submittals.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Refrigerant Recovery Technician Qualifications: Comply with requirements as outlined in other sections.

C. Regulatory Requirements: Comply with transportation and Disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be Salvaged and Recycled.
   2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Comply with requirements in any requirements in Division 02 for salvaging Demolition Waste.

B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean Salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install Salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items for Sale and Donation: Not permitted on Project site.

D. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
1. Clean Salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

G. Plumbing Fixtures: Separate by type and size.

H. Lighting Fixtures: Separate lamps by type and protect from breakage.

I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved Construction Waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 4-inch (~100 mm) size.
   1. Crush asphaltic concrete paving and screen to comply with requirements in other sections for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
   1. Pulverize concrete to maximum 4-inch (~100 mm) size.
   2. Crush concrete and screen to comply with requirements in other sections for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet Recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet Recycler.

M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

N. Conduit: Reduce conduit to straight lengths and store by material and size.

O. Lamps: Separate lamps by type and store according to requirements in 40 CFR § 273.5.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be Salvaged or Recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be Salvaged or Recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for contract closeout, including the following:
      a. Substantial Completion procedures.
      b. Final completion procedures.
      c. Warranties.
      d. Final cleaning.
      e. Repair of Work.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit list of items to be completed and corrected (Contractor's punch list), indicating value of each item on list and reasons why Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of five (5) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including Project record documents, operation and maintenance manuals, damage or settlement surveys**,** property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Program Construction Manager. Label with manufacturer's name and model number where applicable.

a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Program Construction Manager's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit Sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of five (5) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit written request for inspection to determine Substantial Completion a minimum of five (5) days prior to date Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Program Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete and submit the following:
1. Final Application for Payment per Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit written request for final inspection a minimum of Five (5) days prior to date Work will be completed and ready for final inspection and tests. On receipt of request, Program Construction Manager will coordinate an inspection with the appropriate parties or will either proceed with inspection or notify Contractor of unfulfilled requirements. Program Construction Manager/Consultants will prepare final

Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at top of each page:
   a. Project name.
   b. Date.
   c. Name of Program Construction Manager.
   d. Name of Contractor.
   e. Page number.
4. Submit list of incomplete items via electronic or paper format.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Program Construction Manager

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
   1. Each Contractor shall provide final cleaning for their Work and Work area completed or as assigned.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for designated portion of Project: [Remove subcategories that do not apply to Project]
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are not planted mulched or paved to a smooth even textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep floors broom clean.
      i. Vacuum and mop concrete.
      j. Vacuum carpet and similar soft surfaces to remove debris and excess nap; clean according to manufacturer’s recommendations if visible soil or stains remain.
      k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
      l. Remove labels that are not permanent.
      m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
      n. Clean plumbing fixtures to sanitary condition, free of stains, including stains resulting from water exposure.
      o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
      p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
      q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, those noticeably dimmed by hours of use, and defective or noisy starters in florescent and mercury vapor fixtures to comply with requirements for new fixtures.
      r. Clean strainers.
      s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

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

END OF SECTION 017700

SECTION 017823 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency Manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit on digital media acceptable to Program Construction Manager. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit one (1) draft copy of each manual at least fifteen (15) days prior to requesting inspection for Substantial Completion. Include complete operation and maintenance directory. Program Construction Manager will return one (1) copy of draft and comment whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit one (1) copy of each manual in final form a minimum of seven (7) days prior to requesting inspection for Final Completion. Program Construction Manager will return copy with comments.
   1. Correct or revise each manual to comply with Program Construction Manager's comments. Submit one (1) copy of each corrected manual within seven (7) days of receipt of Program Construction Manager's comments.

1.3 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one (1) factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Name and contact information for Commissioning Authority.
   9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operations and Maintenance Documentation for HVAC&R Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
   1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
   3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.

7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference

Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
      a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017823

SECTION 017839 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous Record Submittals

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one (1) set of clean marked-up Record Prints.

B. Record Specifications: Submit three (3) copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit (3) three copies of each Product Data submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one (1) set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints in red pencil to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.

j. Changes made by Change Order or Construction Work Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Program Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
2. Format: **DWG**, Version **Microsoft Windows** operating system.
3. Format: Annotated PDF electronic file **with comment function enabled**.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to through Program Construction Manager for resolution.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Program Construction Manager.
e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

1.5 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file of Specifications.

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications**,** and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file
   1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.8 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.9 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Program Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017839

SECTION 017900 – DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit two (2) copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. At completion of training, submit one (1) complete training manual(s) for Owner's use.

B. Qualification Data: facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.
   1. Identification: On each copy, provide an applied with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Program Construction Manager.
      e. Name of Contractor.
      f. Date of video recording.
   2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
   3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   4. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment & devices.
   2. HVAC instrumentation and controls.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.

f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail.
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Product maintenance manuals
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.

b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish an instructor to describe Owner's operational philosophy.
2. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner, through Program Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

F. Cleanup: Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
1. Submit video recordings on thumb drive or by uploading to web-based Project software site.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.

3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed fifteen (15) minutes.
    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds fifteen (15) minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017900

SECTION 019113 – HVAC AND ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Owner Program Requirements and Basis of Design

1.2 GENERAL DESCRIPTION

A. Commissioning is the process of verifying and validating that all building Systems are installed and perform interactively according to the design intent; that Systems are efficient and cost effective to operate and meet the Owner's operational needs; that the installation is adequately documented; and that Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building Systems from installation to full dynamic operation and optimization.

B. Commissioning provider shall work with the Contractor and the Engineer to direct and oversee the Commissioning process. Contractors and subcontractors shall:
   1. Utilize Procore collaboration software to maintain an Observation Log, Equipment installation and Start-Up status.
   2. Interface with the commissioning process using Procore web interface and/or an Apple iPad.
   3. Generate a Commissioning Plan including schedule.
   4. Integrate commissioning activities into the general construction schedule.
   5. Provide commissioning specifications.
   6. Attend commissioning kick-off and coordination meetings.
   7. Verify that applicable Equipment and Systems are installed according to the contract documents, manufacturer's recommendation, and industry accepted minimum standards and that they receive adequate operational checkout by the installing contractors.
   8. Verify and document TAB is complete and accurate.
   9. Verify and document proper performance of Equipment and Systems.
   10. Verify that O&M documentation left onsite is complete.
   11. Verify that the owner's operating personnel are adequately trained.
   12. Assist Commissioning Provider with any documentation needed for their Final Commissioning report.

C. The Commissioning Plan details the commissioning process.

D. The Commissioning process does not take away from or reduce the responsibility of the System designers or installing contractors to provide a finished and fully functional product as defined in the plans and specifications.

E. This Section and other Sections of the specifications detail the Contractor's responsibilities relative to the Commissioning process. It expands on the Commissioning Plan, which covers the roles and responsibilities of all Parties. It also indicates the details of the Functional Performance Testing in which the Contractor must participate.

1.3 SUMMARY

A. Section includes:

1. General requirements that apply to implementation of commissioning without regard to specific Systems, assemblies, or Components.

B. Specific Equipment/Systems to be utilized is “To Be Determined” (TBD) at this time. At minimum, the following general Equipment/Systems shall be commissioned:
   1. HVAC System and controls.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Terminal Units.
   6. Vibration Control devices.
   7. Lighting Control System.
   8. Domestic Hot Water System.
   9. Metering.

C. References:
   1. ASHRAE Standard 202-2018, “The Commissioning Process for Building and Systems.”
   2. ASHRAE Guideline 0-2019, “The Commissioning Process.”
   3. ASHRAE Guideline 1.1-2007, "HVAC&R Technical Requirements for the Commissioning Process."
   4. International Building Code (IBC).
   5. NEBB - Procedural Standards for Building Systems Commissioning
   6. National Electric Code (NEC)

D. Related Sections:
   1. Section 017823 “Operation and Maintenance Data” - Scope and procedures for operation and maintenance manuals and project record documents.
   2. Section 017839 “Project Record Drawings” - Scope and procedures for project record documents.
   3. Section 017900 “Demonstration and Training” - Scope and procedures for Owner personnel Training.
   4. Section 230593 "Testing, Adjusting and Balancing for HVAC."
   5. Section 230923 "Direct digital Control Systems for HVAC."
   6. Section 230933 "Variable-Frequency Motor Controllers."
   7. Section 230993 "Sequences of Operation for HVAC Controls."

1.4 DEFINITIONS

1. Acceptance Phase: This is the phase of the project when the facility and its Systems and Equipment are inspected, tested, verified, and documented; and when most of the Functional Performance Testing and formal training occurs. This will generally occur after the Construction Phase is complete (Start-Up and checks have been accomplished). The Acceptance Phase typically begins with Substantial Completion and ends with Functional Completion.
2. A/E: General reference to the Architect/Engineer lead-design entity.
3. Building Automation System (BAS): The computer-based heating, ventilation and air-conditioning (HVAC) control or automation System.
4. Commissioning Authority (CA): The Party retained by the Owner who will oversee the commissioning process as well as develop and stipulate many of the commissioning requirements. The CA will also manage the commissioning process as well as ensure and validate Systems and Equipment are designed, installed, and tested to meet the Owner's requirements.

5. Commissioning Coordinator (CxC): The individual within each of the various parties that is designated the point of contact for that party relative to commissioning activities.
6. Commissioning Plan: A Contract Document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. It also describes the FPTs that will be performed during the Acceptance Phase. The Contractor must have an understanding of commissioning process and the Contractor requirements within the plan.
7. Commissioning Team (CxT): The parties involved in the commissioning process for any given System. The CxT will include a core group involved with all Systems. The core group will typically include the CA, the PCM's CxC and the Owner's CxC. On any given System, the CxT will also include the CxC for the Contractor(s) responsible for the System or Equipment.
8. Contractor: A general reference to the installing party and can therefore refer to a contractor, subcontractors, or vendors as inferred by its usage. A contractor generally refers to the person or entity who has agreed with the owner to perform work. A subcontractor is any person who has agreed with the contractor to perform work. A vendor is a provider of materials, supplies, or Equipment. If a vendor also installs or provides additional services beyond providing materials, supplies, or Equipment, vendor is a subcontractor or contractor depending upon the party with which it entered a contract.
9. Construction Phase: The phase of the project during which the facility is constructed and/or Systems and Equipment are installed and started. Contractor and subcontractors complete the installation, complete Start-Up documentation, submit O&M information, establish trends, and perform any other applicable requirements to get Systems started. Contractor and vendors may also conduct Equipment specific training. The Construction Phase will generally end upon completed Start-Up and TAB of Systems and Equipment.
10. Deficiency: A condition in the installation or function of a Component, piece of Equipment or System that is not in compliance with the Contract Documents, such as the Component, piece of Equipment or System does not perform properly or does not complying with the design intent.
11. Engineer: Licensed Professional Engineer that designed and stamped the project reflecting his or her specific area of certification and expertise.
12. Factory Authorized Representative: An individual fully trained on the Equipment and certified by the manufacturer to Start-Up Equipment, perform the respective task, and make reports.
13. Factory Start-Up: Start-up of Equipment by a Factory Authorized Representative.
14. Functional Performance Testing (FPT): The detailed and thorough testing of building Systems and their interactions with building Components and other building Systems.
15. IAQ: Indoor Air Quality.
16. Installation, Operation and Maintenance (IO&M) Documentation: This refers to Contractor-developed documentation designed to address the needs of facilities personnel and customized for the context of the specific facility and installation. The foundation of IO&M Documentation is manufacturer's literature (including 'installation and operational and maintenance manual', parts lists, troubleshooting guides, etc.) as well as Contractor-developed instructions for Start-Up and shut-down, sequences, and other installation-specific information. IO&M Documentation content is a subset of the Facility Manual, so it is common for only one or the other to be specified. All documentation shall be submitted to Owner in electronic format.
17. Installation Verification: Preliminary testing accomplished during a scheduled System outage to verify System functionality prior to placing the System/Equipment into preliminary service.
18. Observation Log: This is a list that is maintained and updated by the commissioning provider that includes all Observation Items that relate to commissioning activities and site observations requiring contractor action or response.
19. Opposite Season: The season opposite that when the majority of the testing occurs.
20. O&M: Operation and Maintenance.

21. Program Construction Manager (PCM): SitelogIQ, Inc., who was retained by the Owner to represent the Owner and make decisions on the Owner's behalf throughout the design and construction process.
22. Start-Up: Refers to the quality control process whereby the Contractor verifies the proper installation of a device or piece of Equipment, executes the manufacturer's starting procedures, completes the Start-Up Checklist, energizes the device, verifies that it is in proper working order and ready for dynamic testing, including Start-Up Tests.
23. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" Systems, Subsystems, Equipment, and Components.
24. TAB: Depending on the context, either the test, adjust, and balance process or the Testing, Adjusting, and Balancing Contractor.
25. Warranty Phase: The warranty period, including any early occupancy of the building and can continue through the warranty period and Opposite Season from when testing initially occurred.

1.5 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The CxT shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CA.

B. Members Appointed by Owner:
   1. Representatives of the facility user and O&M personnel.
   2. A/E design professionals.

1.6 OWNER RESPONSIBILITIES

A. Assign O&M personnel and schedule them to participate in CxT activities.

1.7 COORDINATION MANAGEMENT PROTOCOL

A. Coordination responsibilities and management protocols relative to commissioning are initially defined below but will be refined and documented in the Commissioning Plan. Contractor shall have input in the protocols and all parties will commit to scheduled obligations. The CA will record and distribute.
   1. Submittals and Shop Drawings: PCM shall distribute the submittal log to the CA. CA shall review the submittal log and communicate which submittals need to be forwarded.
   2. CA Review Comments for Shop Drawings: An email reply is sent directly to the PCM, A/E, and Owner by the CA. The Owner and A/E will consider and incorporate at their discretion.
   3. Deficiencies Identified by the CA: When the CA identifies a Deficiency, the CA shall make a good faith assessment of responsible parties. Those parties, as well as the Owner and PCM shall be notified of the perceived Deficiency. This communication is “FOR INFORMATION ONLY” and is not a direction to resolve the Deficiency or to take any action. Contractor may elect to accept responsibility and resolve the Deficiency. If the Contractor contests either the Deficiency or responsibility for that Deficiency, Contractor shall respond to that Deficiency indicating disagreement. If responsibility is not agreed to via the commissioning dialogue, PCM shall issue a work directive or RFI via the normal contractual channels to resolve the issue.
   4. Requests for Meetings: In general request by the contractor for a meeting with the CA shall be routed through PCM who will then determine the validity. Note that every attempt should be made to deal with commissioning issues at regularly scheduled commissioning Meetings.
   5. Control Sequence Modifications: CA shall review the sequences during the design and submittal phases and address any known issues prior to the submittal approval. However, CA and the

contractor may incorporate minor changes to the sequence during testing when it is apparent that it improves the control of the Equipment but does not fundamentally change the sequence, subject to the approval of the Owner and A/E. Any and all changes must be thoroughly documented in the record documents.

6. Notification of Completion Milestones: Contractor shall notify the CA, Owner and PCM at least one (1) week prior to any anticipated commissioning activity or commissioning milestone (such as FPT). The Owner or PCM (as applicable) shall then coordinate the scheduling of the activity between all required parties. Notification shall be via email.
7. Observation Log: CA maintains a categorized Observation Log which tracks the commissioning related action items. Any party that is copied on an email resulting from an Observation Item posting may respond to it and contribute to the dialogue. CA normally distributes a copy of the current open items on the action list with each site visit report.
8. Start-Up Checklist and Test Documents: Minimum Start-Up and documentation requirements are listed in the respective sections of the specifications for controls and mechanical commissioning. The Contractor then performs the reviewed and approved Start-Up procedures, completes the documentation and signs, and submits it. CA subsequently spot checks the procedures and documentation during the FPT. They are then included in the commissioning record.
9. FPT Documents: FPTs are witnessed and documented by the CA but performed by the contractor. They are developed during the Construction Phase generally after completed submittals. CA drafts and forwards the FPT procedures to the PCM to be subsequently distributed to the subcontractors for review by the PCM. Contractor's review and comment on the procedures. Throughout the commissioning process, CA maintains a current record of the testing procedures and keeps the documentation up to date and accessible for all to access the current progress. Upon request, the CA will provide an electronic copy of completed functional test procedures at any significant stage of commissioning.

B. Coordination Between Testing Parties
   1. Factory Start-Ups: For many Systems and Equipment, Factory Start-Ups are specified. The Contractor is responsible for providing onsite support for the Factory representatives. These Factory Start-Ups will be reviewed and checked during FPT. All costs associated with the Factory Start-Ups are included with the bid unless otherwise noted. Contractor shall make notification of when Factory Start-Ups are occurring and coordinate these with witnessing Parties. The CA and CxT members may witness Factory Start-Ups at their discretion. Aspects of FPT accomplished during the Factory Start-Ups may be accomplished and approved by the CA if they meet the intent of the FPT. It is assumed that the Factory representatives budget the appropriate numbers of trips to support initial Start-Up, resolving Equipment issues, TAB and training.
   2. Independent Testing Agencies and Special Inspectors: For Systems where contractor's independent testing agencies or special inspectors are specified, the cost of this testing is included with the bid unless otherwise noted. Much of the testing performed by these independent agencies or special inspectors will cover aspects required in the Start-Up Procedures and FPTs.
   3. Contractor, testing agencies, and special inspectors shall coordinate with the CA so that the CA can support the testing (when necessary), witness the testing, and approve the applicable aspects of the FPTs. The Contractor should not start up Equipment or Systems without CA approval.
   4. The CA may independently spot-check work of the testing agencies or special inspector if the tests were not witnessed. However, it is not the intent for the CA to re-accomplish testing by others that is specified in the construction specifications.

5. Contractor is responsible for coordinating the efforts of testing agency or special inspector with that of the commissioning process. Documentation shall be contiguous and seamless, and duplication will be avoided. Testing agencies or special inspectors shall complete the documentation of the commissioning process as required.

1.8 CONTRACTOR RESPONSIBILITIES

A. Construction Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Construction Phase. The Contractor shall:
   1. Include commissioning requirements in price and plan for work.
   2. Designate a CxC from each major subcontractor with activities related to commissioning. These CxCs are to be the primary contacts for commissioning activities.
   3. Attend Construction Phase commissioning kick off meeting. The CxC and project manager from each major subcontractor shall attend at a minimum.
   4. The CxC shall attend all commissioning progress meetings unless otherwise agreed to by the CA.
   5. Remedy any Deficiencies identified throughout construction.
   6. Submit Start-Up procedures along with the manufacturer's application, installation and Start-Up information to the CA for review prior to implementation.
   7. TAB shall submit Project specific TAB Plan and sample balancing forms for approval prior to starting work.
   8. Contractor shall incorporate the commissioning process into the construction schedule outlining generic commissioning tasks with precedents or prerequisites to each task. These tasks will apply to many Systems and the Contractor shall incorporate as such. Examples of enumerated tasks include:
      a. Contractor preparation of the training plan.
      b. Independent testing agency activities.
      c. Contractor documentation of pipe pressure testing, flushing, and cleaning of applicable Systems.
      d. Documentation of the Start-Up procedures for Equipment and Systems
      e. TAB of applicable System
      f. Training events
      g. Preparation of the IO&M manual content
      h. FPT and acceptance
      i. Observation period and System optimization
      j. Occupant or other regulatory agency testing or approval process
   9. Coordinate the work of subcontractors, vendors, manufacturers, testing agencies and special inspectors provided with the bid, and ensure that they are informed of and are adhering to the requirements of the commissioning process specified throughout the contract documents. particular reference is made to providing the required IO&M Documentation; submittal of training materials and documentation of that training; collaboration with the overall Start-Up and testing process; developing comprehensive integrated procedures for scheduling and task notification and documenting them in a common format; and electronic delivery requirements if applicable.
   10. Provide assistance to the CA in preparation for the specific FPT procedures. Contractors, subcontractors, and vendors shall review the FPTs to ensure feasibility, safety and Equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to Equipment performed in accordance with the approved procedures that is the result of malfunctioning Equipment or contract Deficiencies, shall be the responsibility of the Contractor.

11. Thoroughly complete and inspect installation of Systems and Equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this section. The Contractor (and subcontractors) shall record, in the form of photographs, compliance to and/or deviation from IAQ standards.
12. Contractor shall notify the CA at least seven (7) days in advance of any tests, Start-Ups, or training. CA shall witness selected tests and Start-Ups. Notification shall be accompanied by a schedule showing the coordinated start date and task duration and all open prerequisites.
13. Start-Up, TAB of Systems and Equipment prior to verification and FPT by the CA. Start-Up procedures shall be in accordance with Contract Documents, reference or industry standards, and commissioning specifications. Provide skilled technicians who are qualified to do the work required. Provide factory trained/authorized technicians where required by the contract documents and stated in the applicable technical section. Generally, Start-Up and testing shall proceed from device checkout to Component checkout, to System checkout, to inter-System checkout.
14. Record Start-Up and testing procedures on Start-Up forms or checklists and certify that the Systems and Equipment have been started and/or tested in accordance with the requirements specified above. Each task or item shall be indicated with the party performing the task or procedure.
15. Demonstrate the operation of all Systems as specified.
16. Certify that Systems have been installed and are operating per Contract Documents and Original Equipment Manufacturer prior to FPT and acceptance.
17. Support/Assist in the building flush-out per. If the flush-out is not performed or is incomplete, then the Contractor shall coordinate an air quality test from an approved industrial hygienist after construction is complete to verify the chemical air contaminants are below the specified limits.
18. Maintain an updated set of record documentation as required by the Contract Documents.
19. Conduct and document Equipment and Systems training events as required by this section and by applicable sections of the specifications pertaining to each piece of Equipment or System and general training requirements.

B. Acceptance Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Acceptance Phase. The Contractor shall:
   1. Work in conjunction with CA in FPT and will generally include the following:
   2. Correct any work not in accordance with Contract Documents.
      a. Operate and manipulate Systems and Equipment to facilitate testing (as dictated in this section, relevant technical sections, and the Commissioning Plan).
      b. Operate and manipulate BAS and other control Systems to facilitate FPT (as dictated in this section, relevant technical sections, and the Commissioning Plan).
      c. Provide point to point and device calibration reports prior to coordination to facilitate FPT.
   3. Maintain record documentation and update and resubmit it after Functional Completion.
   4. Compensate the Owner for additional CA fees and expenses incurred to retest Equipment and Systems following testing failures.
   5. Monitor Systems, Equipment, and areas throughout the Acceptance Phase.
   6. Log and diagnose all alarms during this period.
   7. Maintain trends and logs of all parameters.
   8. Forward the logs and trends on a weekly basis throughout the Acceptance Phase.

C. Warranty Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Warranty Phase. The Contractor shall:
   1. Provide warranty service.

2. Conduct BAS Sequence Training.
3. Respond to and document warranty issues.
4. Participate as required in the Opposite Season testing.
5. Correct any Deficiencies identified throughout the Warranty Phase.
6. Update record documentation to reflect any changes made throughout the Warranty Phase and resubmit final record drawings and data records at the close of the Warranty period.

1.9 DESIGN REVIEW

A. The A/E provides the CA a design development (DD) set for review; the drawing set should be near 100% complete. The CA reviews the design set for inconsistencies, misses, OPR & BoD compliance, and opportunities for improvement. The CA documents their comments and provides them to the A/E for incorporation into the design set.

B. The A/E provides a Construction Document (CD) set that is near 50% and/or 90% complete to the CA for review. The CA reviews the set to verify previous comments have been addressed and to identify any further misses or opportunities. The CA documents their comments and provides them to the A/E for incorporation into the construction set.

1.10 COMMISSIONING PLAN

A. The CA will develop the Commissioning Plan and its elements shall be included in the project schedule when approved by the Owner or PCM. The following provides an overview of the commissioning tasks discussed in the Commissioning Plan.
   1. Commissioning program overview - Goals & Objectives, general project information, System to be commissioned.
   2. CxT - Team members, roles & responsibilities, communications & protocols, meetings, and management
   3. Commissioning process activities - Review submittals, development of System FPT, verify System performance, report Deficiencies & the resolution process, accepting the building System and training.
   4. Commissioning schedule - A commissioning schedule will typically include start and end dates for the following.
      a. Design set review
      b. CD set review
      c. Bid packages released
      d. Distributed power available
      e. Distributed water available
      f. Start-Up tests
      g. Point to Point
      h. TAB
      i. FPT
      j. Training

1.11 OBSERVATION LOG

A. CA shall maintain an Observation Log (required information, identified Deficiencies, work required, etc.) that relates to commissioning. Each item shall be tracked with the initiator, the parties responsible, due date, the date of closure, and a description of the resolution. Each item shall be categorized for sorting and tracking and for documentation on applicable forms.

B. CA will disseminate this list as appropriate to keep all parties informed.

C. All parties indicated as responsible for an action item shall respond. The preferred response method is via e-mail. Response with a plan of action (either repair or plan to resolve) is expected within forty-eight (48) hours.

PART 2 - PRODUCTS

2.1 INSTRUMENTATION

A. All test instruments described in this section shall be acceptable for any portion of the commissioning process herein described. All instruments shall conform to the standards specified in the most recent edition of "NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" in regard to accuracy and calibration status. Current calibration certificates must be available to the CA as requested.

B. Test instrument accuracy and resolution must match or exceed that of the System Component being verified or calibrated.

C. Test instruments must be used within guidelines as recommended by instrument manufacturer. All measuring methods must be appropriate to the instrument application and measurements must be repeatable under equivalent conditions.

D. Standard Testing Instrumentation: Standard instrumentation normally used for performance assessment and diagnosis will be provided by Contractor. These include:
1. Electronic Manometer (for Air and Flow Hood)
2. Electronic Manometer (for Water)
3. Temperature Instruments
4. Humidity Instruments
5. CO2 Instrument
6. Sound Meter
7. Electronic Multimeter
8. Tachometer
9. Ultrasonic Flow Meter
10. Thermal Infrared Camera
11. Others as required

PART 3 - EXECUTION

3.1 INSTALLATION VERIFICATION

A. All Equipment, Components, and devices applicable to Installation Verification must be installed, and the Installation Verification must be documented and approved. This includes installation, identification labeling, insulation, and all other requirements for placing Systems into dynamic operation.

B. Required submittal documentation shall be present and located convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements.

C. Contractor shall provide the completed Installation Verification procedures at the time of testing. CA shall review the Installation Verification procedure documentation and spot-check at the beginning of Start-Up.

D. Contractor shall demonstrate that access is sufficient to perform required maintenance.

E. System and Equipment configurations shall be compared against the Contract Documents.

3.2 START-UP CHECKS

A. All Equipment, Components, and devices applicable to the FPT must be started, and the Start-Up must be documented and approved. This includes completion of Start-Up Procedures, pressure testing (of Equipment, duct and piping), flushing/cleaning, identification labeling, insulation, and all other requirements for placing Systems into dynamic operation.

B. Unless specifically agreed to by the Owner and CA, all support Systems shall be complete prior to FPT. For instance, an air handler will require that:
   1. The electrical System serving it is completed and tested.
   2. The hydronic Systems serving it have been pressure tested, flushed, and FPT.
   3. Balancing has been completed.
   4. The control Systems have been started and calibrated.
   5. The CA shall determine the optimal sequence of testing.

C. Required submittal documentation shall be present and located convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements.

D. Contractor shall provide the completed Start-Up procedures at the time of testing. CA shall review the Start-Up procedure documentation and spot-check at the beginning of FPT.

E. Contractor shall demonstrate that access is sufficient to perform required maintenance.

F. BAS trends shall have been established as required in the documents. These shall generally be reviewed prior to or during FPT.

G. Capacities and adjusted/balanced conditions as applicable shall be subject to review.

H. Sequencing verification: For applicable Systems and Equipment, all modes of operation shall be verified for proper sequencing.

I. System and Equipment configurations shall be compared against the contract documents.

J. Verify Modes (such as heating and cooling) are coordinated and do not overlap or 'fight'.

K. All adjusted, balanced, controlled Systems shall be assessed to determine the optimal setting for the System as applicable. The optimal settings should be determined to establish reliable, efficient, safe and stable operation.

L. BAS or local panel dynamic graphics: The graphic displays for all Components, Systems, and areas required to be represented by a graphic shall be checked for adequacy and accuracy. Furthermore, when setpoints or other parameters are required to be adjustable, CA shall verify that they can be adjusted directly from the graphic screen.

3.3 START-UP PROCEDURE

A. Purpose: The commissioning process requires that the normal quality control processes involved with preparing Systems and Equipment for operation are performed to a high standard of care and are thoroughly documented. The required commissioning-related Start-Up Procedures involve nothing additional over that which would be done for a proper installation. These procedures shall be performed on all installed

Systems and Equipment and no sampling strategy is used for the Start-Up process. The commissioning process requires all Parties to collaborate to establish the optimal standard of care for starting Systems and Equipment. After the procedures are established, the Contractor performs them and documents them with the Start-Up Procedures that are developed by the Contractor.

B. Start-Up Procedures: The content of these Start-Up Procedures shall provide the minimally acceptable content in accordance with the original Equipment manufacturer field quality control requirements. These procedures and protocols will normally be common across different manufacturers.

C. Content of Start-Up Procedures: Start-Up Procedures shall generally include the following for each item of Equipment or System (as applicable):
   1. Project-specific designation, location and service.
   2. Indication of the party performing and documenting the Start-Up Procedure.
   3. Clear explanation of the inspection, test, measurement, and outcome with a Pass/Fail indication and a record of measure parameters.
   4. A Start-Up checklist item indicating that proper maintenance clearances have been maintained.

D. Recording and Documentation of Factory Start-Up: Manufacturer's Start-Up protocols shall be executed, and forms shall be completed by a qualified/authorized technician.

E. Recording and Documentation of non-Factory Start-Up: The Start-Up tests and checklists shall be completed by a qualified technician.

F. CA Review: CA will review and spot-check procedures during FPT.

G. Documentation Completion: The individual executing the Start-Up must complete the Start-Up and pre-functional documentation for any given Equipment and acknowledge acceptability with the indication of who did the associated task.

H. Sampling and Final Submission: All (one hundred percent (100%) of) Systems are started and documented per the approved procedures and NO sampling strategy is used. Completed Start-Up and pre-functional checklists for all pieces of Equipment associated with independent Systems shall be submitted to CA prior to any associated FPT. Any outstanding item shall be clearly indicated, and an associated Action Item must be entered to track resolution.

I. Owner Access: Contractor shall allow access by Owner representatives to inspect the Equipment and ensure its proper operation.

3.4 POINT TO POINT PROCEDURE AND BAS VERIFICATION

A. A documented, comprehensive point to point and basic function testing in the field is required on all installations. Factory calibration and bench tests are not acceptable alternates to onsite field-testing.

B. Point to point (or calibration verification) scope of work consists of testing from all end field devices (any device that provides an input signal to or receives an output signal from the control hardware) through proper input/output to the graphic and operator interface. Testing must be complete, detailed and documented on approved point to point verification forms. Point-to-point should be performed with a separate device from the installation sensor - “ringing out a sensor” alone is not an acceptable level point-to-point testing. Point to point testing forms will include all point database requirements (i.e. alarm priority, paging, email, device range, etc.).

C. Submittal of the control provider's forms for approval must take place three (3) weeks prior to commencement of field testing. The point-to-point report summary documentation must include the signature of the test technicians and date completed. The technician's signature certifies that the

System has been tested and is fully ready for the commissioning lead's performance verification testing.

D. The CA will select up to ten percent (10%) of the readings from the BAS reports and spot check them, as part of the time allocations for the various Systems. If subsequent failures are found, the controls Contractor will be required to justify noted failures or re-verify and re-document the System.

E. The maximum failure rate for this sample is ten percent (10%). The readings selected by the CA may include air temperature, fluid temperature, air flow rate, liquid flow rate, differential pressure, gauge pressure, relative humidity, CO concentration, CO2 concentration, and refrigerant monitoring.

F. For all readings a deviation of more than the below between the verification reading and reported data shall be considered as failing the FPT

Sensor Application	**Accepted BAS Tolerance**
Airflow (Pressurized Spaces)	± 3 %
Airflow (Measuring Stations)	± 5 %
Airflow (Terminal)	± 10 %
Air Pressure Differential (Space)	± .001 in wg
Air Pressure (Ducts)	± .01 in wg
Air Relative Humidity	± 2 % RH
Air Temperature (Ducted)	± 1 deg F
Air Temperature (Room, AC unit, TU, etc.)	± 1 deg F
Air Temperature (Outside)	± 2 deg F
Air Wet Bulb Temperature Outdoor (Dew point)	± 2 deg F
Air Wet Bulb Temperature Indoor (Dew point)	± 1 deg F
Air Temperature Differential	± .25 deg F
Carbon Dioxide Monitor	± 50 PPM (of mid-range)
Carbon Monoxide Monitor	± 5 % (of mid-range)
Oxygen Monitor	± 5 %
Refrigerant Monitor	± 5 % (at 50 PPM)
Fluid Flow	± 5 %
Fluid Pressure	± 2 % (of full-scale)
Fluid Temperature	± 1 deg F
Electrical	± 5 %
Thermal Energy	± 5 %
Steam Flow	± 5 %
Steam Temperature	± 2 deg F
Vibration	± 5 %

■Notes:
Accepted calibration tolerances will vary according to measured medium and application of sensors.
The tolerances listed are standard accepted criteria.
Not all sensors listed above may be in the project.

3.5 TEST, ADJUST, AND BALANCE

A. CA shall review TAB Plan, Draft/Final TAB reports.

B. The CA will select up to ten percent (10%) of the readings from the Balancing Reports and spot check them, as part of the time allocations for the various Systems. If subsequent failures are found, the TAB contractor will be required to justify noted failures or rebalance and re-document the System.

C. The maximum failure rate for this sample is ten percent (10%). The readings selected by the CA may include supply air diffuser readings (both minimum and maximum readings for variable air volume boxes), main and branch supply duct traverse readings, outside/return air flow readings, exhaust air flow readings, water flow readings, amp readings, and water pressure drop readings through coils, heat exchangers, and other hydronic elements.

D. For all readings a deviation of more than ten percent (10%) between the verification reading and reported data shall be considered as failing the FPT.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. Objectives and Scope:
   1. The objective of FPT is to demonstrate that each System is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the Systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, thus improving the function and operation of the Systems.
   2. Each System shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, normal [and emergency power], fire alarm, part- and full-load) where there is a specified System response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, Equipment failure, etc. shall also be tested.

B. Development of Test Procedures:
   1. CA shall develop specific test procedures and forms to verify and document proper operation of each piece of Equipment and System. Prior to execution, the CA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, Equipment and warranty protection, and scope. The CA will also submit the tests to Owner for review.
   2. Contractor shall review the FPTs in detail and submit edits and comments to the CA for possible incorporation.
   3. The purpose of any given specific FPT is to verify and document compliance with the stated criteria of acceptance, modes of operation and performance.

C. Scheduling: After Contractors' notification that Systems are ready for testing and submittal and review of all the required submittals has occurred, PCM shall schedule the testing. To the extent practical, tests shall be scheduled to allow efficient and contiguous testing of inter-related Systems and Equipment.

D. Phasing: Non-interdependent segments of the project testing can be phased. Phasing of this project will be determined as the project progresses.

E. Participation: CA will direct, witness and document FPTs performed by the contractor after Start-Up Procedure documentation of Systems and Equipment has been reviewed and accepted. CA will orchestrate the execution of the FPTs unless otherwise specified. Contractor shall perform the FPTs with manipulation of the Systems or Equipment, provision of supporting Equipment or materials (lifts,

ladders, specialty test equipment, safety equipment), and on-the-spot remediation of minor identified Deficiencies whenever possible.

1. Required participating Parties shall be indicated in the individual FPT. Typically, multiple Parties are required for any given test, yet participation for any given party is only required for the respective portion of the test for which the party is responsible.
2. Frequently, on multiple samples where a given party does not directly perform the test, the participation of that party will only be required for an initial quantity of Systems/Equipment. Whenever practical and at the discretion of the CA with the Contractor's full approval, the CA will continue with the remaining portion of the sample without assistance from the Contractor(s) not directly performing the test. However, the Contractor is allowed to be present for any or all FPTs conducted.
3. The required parties shall be available on-site throughout the testing of any given System for which they are required participants. Therefore, time for which they are not directly involved can be spent performing other work (typically addressing identified punch list items or failed tests).
4. No party involved with the Project is prohibited from participation in or witnessing of any tests. Any Contractor may elect to witness all tests on their Systems even if their involvement is not directly required (for instance, BAS vendor involvement is sometimes required on the first few of a sample and not on the entire sample).
5. CA will endeavor to coordinate effectively with the individual Contractors throughout FPT and minimize their required involvement.

F. Completeness: All Systems must be completed and ready for FPT. All start up, factory authorized field testing, independent testing agency tests, and TAB procedures must be complete, and the control Systems must be tested and started for the respective System or Component.

G. Test Documentation: CA will witness and document the tests. CA will record all test results on the forms developed for the testing. CA will pass or fail the testing and record the date and time of the test. Deficiencies shall clearly be indicated when the test is failed. When all related testing is completed successfully, CA shall recommend acceptance of the System or Component. In the case of specialized testing, witness (at CA's discretion) and review the testing reports prepared by the Contractor.

H. After functional testing is completed, all settings adjusted to test the Equipment/System will be returned to normal.

I. FPT Acceptance:
   1. The Acceptance Criteria shall be as follows unless specifically indicated within applicable individual specification sections or test procedures. CA may exercise professional judgment to relax requirements and pass tests and recommend approval by the Owner and Engineer when appropriate.
   2. Accuracy/repeatability on sensing devices will be as specified for the device. CA and TAB will use calibrated gages for independent validation and use judgment in passing or failing the devices. In many cases, the coordination of multiple related sensors is more important than absolute accuracy.
   3. HVAC sequence-related criteria will be as explicitly specified in the documents and as interpreted by the CA.
   4. Testing may be deferred due to seasonal or operational constraints. In either situation the testing will be coordinated and be governed by the specifications for the project.

J. FPT Deficiencies:

1. Non-Conformance: Non-conformance Deficiencies identified during FPT shall be resolved as follows:
    a. The CA will record the results of the functional test. All Deficiencies or non-conformance issues shall be noted as Observation Log Items and reported to the Owner and PCM.
    b. Corrections of identified minor Deficiencies may be made during the tests at the discretion of the CA. In such cases the Deficiency will be noted on the FPT documents.
    c. Every effort will be made by the CA to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
    d. As tests progress and Deficiencies are identified, the CA will discuss the issue with the executing Contractor.
    e. When there is no dispute on the Deficiency and the Contractor accepts responsibility to correct it:
        1) The CA shall document the Deficiency along with the Contractor's response and intentions, and they go on to another test or sequence. A copy/email of the Deficiency shall be generated and provided to the Contractor and CA. The Contractor corrects the Deficiency, completes the action item response certifying that the issue is resolved and/or the Equipment is ready to be retested, and sends it back to the CA.
    f. The CA reschedules the test and the test is repeated until satisfactory performance is achieved. Then, CA closes the action item. If there is a dispute about a Deficiency, regarding whether it is a Deficiency and/or who is responsible:
        1) The Deficiency shall be documented as an Observation Log Item with the Contractor's response and the Owner and PCM will be notified. The PCM will track this issue under the construction contract dispute resolution provisions.
        2) Final interpretive authority is with the A/E. Final acceptance authority is with the Owner and PCM.
        3) The CA documents the resolution to the Observation Log item.
        4) Once the interpretation and resolution have been decided, the appropriate party corrects the Deficiency, and responds to the action item indicating completion.
        5) The CA reschedules the test and the test is repeated until satisfactory performance is achieved. Then, CA closes the action item.

K. Max Failure Limit and Sample Percentages: A Maximum Failure Limit is indicated along with the Sampling Percentages. The Max Failure Limit indicates the maximum percentage of the tested devices that may have any test that fails before an entirely new sample must be tested. This is based on the concept that if many failures occur, it is a result of inadequate Start-Up by the Contractor. When the maximum number of failures is reached, testing on that sample will be terminated and re-testing will be scheduled.
    1. If no Max Failure Limit is indicated, all tested samples must pass (Max Failure Limit zero percent (0%)).
    2. Where sample tests involve multiple Systems (i.e., checking strainers on different hydronic Systems) the Maximum Failure Limit will apply per System.
    3. The responsible Contractors shall reimburse the Owner for the CA's cost of that sample test, and redo the Start-Up and TAB for the applicable devices/Systems.
    4. All work necessitated by sample failures shall be at no cost to the Owner.

L. Failure Due to Manufacturer's Defects: If ten percent (10%) of “Identical Equipment” fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, all identical units may be considered unacceptable by the PCM. For the purposes of defining “Identical Equipment” for this Section, size or capacity alone does not constitute a difference. In case of failure due to manufacturer's defects, the Contractor shall provide the Owner with the following:

1. Manufacturer's response in writing as to the cause of the failure and proposed resolution.
2. Manufacturer shall implement their proposed resolution on a representative sample of the product.
3. The PCM will determine whether a replacement of all identical units or a repair is acceptable.
4. Upon acceptance, the manufacturer shall replace or repair all identical items at their expense and shall extend the warranty accordingly (if the original Equipment warranty had begun).
5. Manufacturer shall pay the costs of all retesting necessitated by the failure.

3.7 ACCEPTANCE

A. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the PCM, if necessary. The CA recommends acceptance of each test to the PCM using a standard form. The PCM gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.8 CLOSEOUT

A. Commissioning Report:
   1. A final summary report by the CA will be provided to the PCM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved.
   2. All acquired documentation, logs, minutes, reports, Deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.
   3. Installation Verification, Start Up checklists, TAB, functional tests and monitoring reports will not be part of the final report, but will be stored in the commissioning record in the IO&M manuals.
   4. Opposite Season testing and additional Factory Start-Ups shall clearly be identified, and the designated test period noted for contractor and owner coordination. See Warranty Period.

B. Code Required Reports:
   1. Provide Contractor with all commissioning reports required by the State of Minnesota and local authorities for compliance with governing energy code and mechanical code.

3.9 TRAINING

A. The PCM shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.
   1. A training plan shall be generated and include the following elements:
      a. Equipment
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subject covered (description, duration of discussion and special methods)
      f. Instructor for each subject
      g. Method of instruction (classroom lecture, manufacturer video, site walk through, actual operational demonstration, written handouts)
   2. The controls Contractor shall attend any training in which their System interfaces (minimally mechanical)
   3. Recommended training
      a. Use printed installed ad IO&M Documentation
      b. Review of IO&M - include Start-Up, all modes of operation, shutdown, seasonal changes, and emergency operations (emphasis should be given on safety and proper operations).

c. Health and safety issues
d. Warranties and guarantees
e. Common troubleshooting
f. Peculiarities
g. Overrides

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned Equipment.

3.10 INSTALLATION, OPERATION AND MAINTENANCE

A. Prior to substantial completion, the CA shall review the IO&M Documentation and redline as-builds for Systems that were commissioned to verify compliance with the Specifications. The CA will communicate Deficiencies in the manuals to the PCM or A/E, as requested.

B. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the IO&M manuals to the PCM or A/E.

C. The CA also reviews each Equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the IO&M Documentation according to the A/E's contract.

3.11 WARRANTY REVIEW

A. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the System's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and Deficiencies corrected by the appropriate subcontractors, with facilities staff and the CA witnessing. Any final adjustments to the IO&M manuals and as-builds due to the testing will be made.

END OF SECTION 019113

SECTION 019114 – CERTIFICATE OF READINESS FOR COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor shall submit the certificate of readiness for commissioning, if commissioning is required to verify Contractor's work conforms to the Contract Documents.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 If Contractor's scope of work requires commissioning to verify Contractor's work conforms to the Contract Document, Contractor shall complete the following certificate of readiness for commissioning.

3.2 COMMISSIONING – CERTIFICATE OF READINESS

Contractor verified the prerequisite items have been completed in preparation for the functional testing of commissioning.

Systems to Be Commissioned: _____

☐ All equipment has been properly started up by qualified personnel. Where specified, the startup was conducted by the manufacturer. Startup procedures and reports have been documented and provided to the CxA.

☐ For Building Automation system (BAS), the BAS contractor has completed their own checkout procedures, including but not limited to the following:

- Calibration of all sensors.
- Point-to-Point checks of all sensors and devices.
- Checks of all devices (dampers, control valves, etc.) for proper operation, fail position, and verification of no leakage.
- Programming of all sequences of operations, alarms, trends, and setpoints.
- Completion and check of all graphics.
- Interface with other systems (lighting, plumbing, metering, etc.)

☐ All equipment and systems are online and operating with no restrictions for testing.

Attach a list of any known exceptions or outstanding issues related to the above statements.

List name, title, company, date: _____

By signing this document, Contractor represents and warrants the above statements are true and correct and Contractor further represents that the above referenced system(s) is/are ready for functional testing by the Project commissioning team, except for the items noted as attached. Contractor understands that if the system(s) is/are found not to be properly prepared, they may be charged by the Owner for additional commissioning testing trips at a rate of $150/hr including the commissioning teams travel time and travel expenses.

Contractor: _____

Print Name: _____

Position: _____

Signature: _____

END OF SECTION 019114

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction in a manner to prevent damage and deliver to Owner as indicated.

C. Remove and Reinstall: Detach items from existing construction in a manner to prevent damage; prepare for reuse; and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and require protection.
6. Review and finalize protection requirements.
7. Review procedures for noise control and dust control.

8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For refrigerant recovery technician.

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

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. On-site sale of removed items or materials is not permitted.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

3.2 PREPARATION

A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

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

D. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
3. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

4. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.

    a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

5. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:

    a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
    b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.4 SALVAGE/REINSTALL

A. Removed and Reinstalled Items:

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

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete:

1. Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing so that building interior remains watertight and weathertight. See Section 075416 “Ketone Ethylene Ester (KEE) Roofing” for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

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

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

END OF SECTION

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 051200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

D. Section 321316 - Decorative Concrete Paving: Formwork related to concrete pavement and walks.

1.3 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 301 - Specifications for Concrete Construction; 2020.

C. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

D. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

2.2 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch (1.52 mm) thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, (25 mm back break dimension,) free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface. .

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Do not use materials containing diesel oil or petroleum-based compounds.
2. Composition: Colorless, reactive, water-based compound.

C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Coordinate this section with other sections of work that require attachment of components to formwork.

G. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117 and to comply with the Surface finish designations specified in Section 033000 "Cast-in-Place Concrete", unless otherwise indicated.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 032000 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 034500 - Precast Architectural Concrete: Reinforcement for precast concrete panels.

D. Section 321313 - Concrete Paving: Reinforcing related to concrete pavement and walks.

1.3 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

C. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2022a.

D. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2019.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

F. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.

G. CRSI (DA4) - Manual of Standard Practice; 2023.

H. CRSI (P1) - Placing Reinforcing Bars, 10th Edition; 2019.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

PART 2 PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Steel Bars: ASTM A615/A615M.

1. Steel Bars: Grade 60 (60,000 psi) (420 MPa).
2. Deformed billet-steel bars.

B. Low Alloy Reinforcing Bars: ASTM A706/A706M.

1. Unfinished.

C. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.

2.2 REINFORCEMENT ACCESSORIES:

A. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

PART 3 EXECUTION

3.1 PLACEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Place, support and secure reinforcement against displacement. Do not deviate from required position.

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Maintain concrete cover around reinforcing as indicated in the structural drawings.

3.2 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.3 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 014000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floors and slabs on grade.

B. Concrete foundation walls.

C. Joint devices associated with concrete work.

D. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

E. Concrete curing.

1.2 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

G. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022a.

L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

M. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

N. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

O. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

P. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

Q. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

S. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2022.

T. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

U. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).

V. ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method); 2021.

W. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.

X. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.

Y. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011 (Reapproved 2022).

Z. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

AA. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.

BB. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

CC. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.

DD. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

EE. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 2017.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
2. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions.

C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Test Reports: Submit report for each test or series of tests specified.

E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Follow recommendations of ACI 305R when concreting during hot weather. Do not place concrete when air temperatures are at or above 95 deg F at time of placement or expected to occur within 24 hours after placement of concrete. Do not place any flatwork concrete (slabs on grade, elevated slabs on deck, concrete toppings) when wind speed exceeds 20 mph at time of casting or anticipated to occur within 24 hours after placement of concrete. Do not place concrete on elevated decks when the total of the temperate (F) plus the wind speed (W mph) divided by 2 exceeds 95[(T + W/2)] 95 at time of placement or expected to occur within 24 hours after placement of concrete.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Blended Hydrualic Cement: ASTMC595/C595M, Type IL, portland-limestone.

1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.2 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

2.3 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

2.4 BONDING AND JOINTING PRODUCTS

A. Slab Isolation Joint Filler: 1/2-inch (13 mm) thick, height equal to slab thickness, with removable top section forming 1/2-inch (13 mm) deep sealant pocket after removal.

2.5 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

1. Product dissipates within 4 to 6 weeks.

C. Moisture-Retaining Sheet: ASTM C171.

1. Curing paper, regular.
2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch (0.102 mm).
3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).

D. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch (0.102 mm) thick, clear.

E. Water: Potable, not detrimental to concrete.

2.6 CONCRETE MIX DESIGN

A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

B. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

C. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cu m), or as recommended by manufacturer for specific project conditions.

D. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
2. Water-Cement Ratio: As indicated on drawings.
3. Air Content: As indicated on drawings.
4. Maximum Slump: As indicated on drawings.
5. Maximum Aggregate Size: 3/4 inch (19 mm).

2.7 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.4 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified in the structural notes.

3.5 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Saw Cut Contraction Joints: As indicated on drawings.

3.6 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values.

1. As indicated in drawings.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) or /F(L).

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7 CONCRETE FINISHING

A. See structural notes for additional requirements.

B. Repair surface defects, including tie holes, immediately after removing formwork.

C. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.

D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

2. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
3. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal unless indicated otherwise on the drawings.

3.8 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
b. Spraying: Spray water over floor slab areas and maintain wet.
c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3. Final Curing: Begin after initial curing but before surface is dry.

a. Moisture-Retaining Sheet: Lap strips not less than 3 inches (75 mm) and seal with waterproof tape or adhesive; secure at edges.
b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

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SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Architectural precast concrete wall panels.

B. Architectural precast concrete accessories.

C. Supports, anchors, and attachments.

D. Grouting under panels.

1.2 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing perimeter and intermediate joints.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

H. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.

I. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2022.

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

K. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

L. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

N. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2022.

O. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2022.

P. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

Q. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale; 2020.

R. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

S. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

T. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

U. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

W. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; 2021.

X. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.

Y. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).

Z. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs.; 2007.

AA. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.

BB. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.5 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.

1. Include details of mix designs.
2. Include structural design calculations.

D. Samples: Submit one sample of each finish type, 1 ft long by 1 footing wide in size, illustrating surface finish, color and texture.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Maintenance Data: Indicate surface cleaning instructions.

1.6 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.

B. Fabricator Qualifications:

1. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.7 MOCK-UPS

A. Provide one mock-up of each finish type, 4ft long by 4 ft wide with attachment points, and finish in accordance with approved sample.

B. See Section 014000 - Quality Requirements for additional requirements.

C. Include mock-up panel with typical window.

D. Locate where directed.

E. Mock-up may not remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Architectural Precast Concrete:

1. Gage Brothers Concrete Products; Sioux Falls, South Dakota.
2. Wells Concrete; Albany, Minnesota.
3. Collins Precast; Iroquois, South Dakota.
4. Terracon Precast, Hawley, Minnesota.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI CODE-318.

1. Concrete Face Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent; comply with ACI SPEC-301.

a. Backup Mix: Same aggregate-cement ratio as face mix.

2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection loads as specified by the construction documents and applicable building codes.
3. Calculate structural properties of units in accordance with ACI CODE-318.
4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Finish Type see construction documents for requirements.

2.3 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).

1. Deformed billet-steel bars.
2. Unfinished.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.

1. Form: Flat Sheets.

2.4 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Other Cementitious Materials:

1. Fly Ash or Natural Pozzolans: Comply with ASTM C618.

C. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

D. Surface Finish Aggregate: As selected by Architect from manufacturer's full range.

E. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.

1. Color(s): As selected by Architect from manufacturer's full range.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

G. Air Entrainment Admixture: ASTM C260/C260M.

H. Grout:

1. Non-shrink, non-metallic, minimum 7,000 psi, 28 day strength.

2.5 REVEAL AND ACCENT STRIPS

A. Manufacturers:

1. Nox-Crete Inc; Clean Line Reveal: www.nox-crete.com/#sle.
2. Substitutions: See Section 016000 - Product Requirements.

B. Material: Non-staining, non-reactive, high-density polyethylene.

C. Profile(s): As indicated on drawings.

2.6 THIN BRICK

A. Thin Brick: ASTM C1088.

1. Basis-of-Design Product: Glen-Gery Corporation, or comparable by one of the following:

    a. Endicott Clay Products Co: www.endicott.com/#sle.
    b. Meridian Brick LLC; Athens Architectural Series: www.meridianbrick.com/#sle.
    c. Metro Brick: www.metrothinbrick.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

2. Type: TBX.
3. Size: Manufacturer's standard Modular.
4. Thickness: 5/8 inch (16 mm).
5. Tolerances: 1/16 inch (1.6 mm).
6. Color, texture, range, special shapes: As selected by Architect from manufacturer's standard range of colors, textures and blends.

    a. Where shown to “match existing,” provide clay face brick matching color range, texture, and size of existing adjacent brickwork.

7. Protective Coating: Wax.

2.7 SUPPORT DEVICES

A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M plain.

1. Clean surfaces of rust, scale, grease, and foreign matter.

B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, plain, with matching ASTM A563/A563M nuts and matching washers.

2.8 INTEGRALLY INSULATED PANEL SYSTEM (PIN CONNECTORS)

A. Integrally Insulated Panel System: Precast concrete panel formed from two layers of concrete with continuous rigid insulation and non-conducting pin connectors between layers.

1. Panel Type: Structurally composite.
2. Connectors: System manufacturer's standard; corrosion- and alkali-resistant, glass fiber reinforced, vinyl ester composite pultrusions with serrated profile, and thermoplastic depth-limiting and sealing collar.
3. Continuous Insulation: Rigid extruded polystyrene (XPS) board insulation, ASTM C578, Type IV; factory fabricated with holes or slots for connectors having manufacturer-designated size and spacing.

2.9 INTEGRALLY INSULATED PANEL SYSTEM (TRUSS CONNECTORS)

A. Integrally Insulated Panel System: Precast concrete panel formed from two layers of concrete with rigid insulation and non-conducting truss connectors between layers.

1. Panel Type: Structurally composite.
2. Connectors: System manufacturer's standard; epoxy coated, interlaid carbon fiber mesh.
3. Continuous Insulation: Rigid extruded polystyrene (XPS) board insulation; ASTM C578, Type IV.

2.10 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Place thin brick in form liner in accordance with manufacturer's instructions. Mix bricks from several cartons for uniform distribution of color variations.

E. Maintain consistent quality during manufacture.

F. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

G. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

H. Integrally Insulated Panel System: Comply with manufacturer's written installation instructions.

I. Locate hoisting devices to permit removal after erection.

J. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

K. Remove protective coating from thin brick using method recommended by manufacturer. Do not damage brick or concrete material in joints.

2.11 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135, except as specifically amended below and as specified in construction documents (whichever is more restrictive).

1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in (2.4 mm).
2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet (1 mm per m).
3. Maximum Variation from Thickness: Plus or minus 1/8 in (3 mm).
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch (3 mm).
5. Maximum Bowing of Members: Plus or minus length/360.

2.12 ACCESSORIES

A. Bearing Pads: High density plastic; Shore A Durometer 80; 1/8 inch (3 mm) thick, smooth both sides.

2.13 SOURCE QUALITY CONTROL

A. Provide testing and analysis of concrete mix.

B. Take 4 concrete test cylinders for every 50 cu yds of concrete placed; make and cure in accordance with ASTM C31/C31M.

C. Take 1 slump tests for every 4 test cylinders in accordance with ASTM C143/C143M.

D. Take one air entrainment test cylinders for each set of exterior concrete test cylinders taken.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.2 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.3 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.

E. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.

F. Touch-up field welds and scratched or damaged primed painted surfaces.

G. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

3.4 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135, except as specifically amended below and as given in construction documents (whichever is most restrictive).

1. Plan Location from Building Grid Datum: Plus or minus 3/8 in (9.5 mm).
2. Top Elevation from Nominal Top Elevation: Plus or minus 3/8 inch (9.5 mm).
3. Maximum Plumb Variation Over Height of Structure or 100 ft (30 m) (whichever is less): Plus or minus 1/2 inch (12.5 mm).
4. Exposed Joint Dimension: Plus or minus 3/16 inch (4.5 mm).
5. Maximum Jog in Alignment of Matching Faces or Edges: Plus or minus 3/16 inch (4.5 mm).
6. Differential Bowing or Camber as Erected Between Similar Adjacent Members: Plus or minus 3/16 inch (4.5 mm).

3.5 PROTECTION

A. Protect installed members from subsequent construction operations.

END OF SECTION

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SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout materials.
3. Miscellaneous masonry accessories.

B. Products Installed, but Not Furnished, under This Section:

1. Steel lintels and steel shelf angles.

C. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Lintel design and types required.

C. Samples for Initial Selection:

1. Architectural CMUs, in the form of small-scale units.
2. Pre-faced CMUs.
3. Colored mortar.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs, if not surface treated.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 402/602.

E. Weather Procedures:

1. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
2. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Project team craftworkers of the Masonry Contractor assigned to Project will be required to have the International Masonry Institute - Grouting and Reinforcing Training or equal and to provide evidence of certificate or a letter of the firm's commitment to enroll key project personnel in the training program prior to the start of Project.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Source Limitations for Integral Water Repellent: Obtain integral water-repellent units from CMU and mortar manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with Tables 1 and 2 in TMS 402/602.

B. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:

1. TMS 402/602:

a. Maintain one copy of the standard in Project field office at all times during construction. Contractor's supervisory personnel are to be thoroughly familiar with this material as it applies to Project.

2.3 CONCRETE UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 402/602 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

D. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing in accordance with ASTM E119, by

equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Standard CMUs: Non-load-bearing ASTM C129.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content is not more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Cement: ASTM C1329/C1329M.

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. Lafarge North America Inc.

E. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C404.

G. Water: Potable.

2.6 REINFORCEMENT

A. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.

1. Interior Walls: Mill- galvanized carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Spacing of Cross Rods: Not more than 16 inches o.c.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For interior non-load-bearing partitions, Type O may be used instead of Type N.

C. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1. Application: Use epoxy pointing mortar for exposed mortar joints with pre-faced CMUs.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Exposed Masonry: Mix units to product uniform blend of colors and textures.

E. Where existing masonry occurs, match coursing, bonding, color, and texture of existing masonry.

F. Temperature Control: Perform temperature-sensitive construction procedures while masonry Work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 deg F.

1. 40 to 32 Deg F (4 to 0 Deg C):

    a. Mortar: Heat mixing water to produce mortar temperature between 40 and 120 deg F.
    b. Grout: Follow normal masonry procedures.

2. 32 to 25 Deg F (0 to Minus 4 Deg C):

    a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F; maintain temperature of mortar on boards above freezing.
    b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.

3. 25 to 20 Deg F (Minus 4 to 7 Deg C):

    a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F; maintain temperature of mortar on boards above freezing.
    b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
    c. Heat both sides of walls under construction using salamanders or other heat sources.
    d. Use windbreaks or enclosures when wind is in excess of 15 mph.

4. 20 Deg F (Minus 7 Deg C) and Below:

    a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F.
    b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
    c. Masonry Units: Heat masonry units so that they are above 20 deg F at time of laying.
    d. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 deg F for 24 hours after laying units.

5. Do not heat water for mortar and grout to above 160 deg F.

G. Masonry Protection: Protect completed masonry and masonry not being worked on as follows: Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.

1. 40 to 32 Deg F (4 to 0 Deg C): Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
2. 32 to 25 Deg F (0 to Minus 4 Deg C): Completely cover masonry with weather-resistive membrane for at least 24 hours.
3. 25 to 20 Deg F (Minus 4 to 7 Deg C): Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
4. 20 Deg F (Minus 7 Deg C) and Below: Except as otherwise indicated, maintain masonry temperature above 32 deg F (0 deg C) 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.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2 inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 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.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."
5. Joint Sealants: Comply with ASTM C1193 for use of joint sealants, including acoustic sealants as applicable to materials, applications, and Project conditions.
6. Penetration Firestopping: Install penetration firestopping systems for Project applications to comply with manufacturer's written installation instructions.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Where applicable, set masonry trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Wet joint surfaces thoroughly before applying mortar.
3. Rake out mortar joints for pointing with sealant.

C. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 CONTROL JOINTS

A. General: Install control joint materials in CMUs as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.

B. Locate control joints. Comply with NCMA TEK 10-02D.

C. Form control joints in CMUs as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.

B. Inspections: Level 1 special inspections to comply with the International Building Code.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces, grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

F. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

H. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 28 days.

I. Fire-Resistance Rated Construction: Where applicable, inspect fire-rated CMU construction to determine compliance with construction documents per building code compliance.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry 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 one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid-strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 08-04A.

3.10 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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SECTION 042613 - MASONRY VENEER

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Mortar materials.
3. Ties and anchors.
4. Mortar mixes.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in masonry veneer.
2. Stone trim units in unit masonry.
3. Steel lintels in masonry veneer.
4. Steel shelf angles for supporting masonry veneer.

C. Related Requirements:

1. Section 034500 "Precast Architectural Concrete" for thin brick incorporated into faces of precast panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.

C. Samples for Initial Selection:

1. Clay face brick.
2. Colored mortar.
3. Weep/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Clay face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Pigmented- and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep/cavity vents.
5. Cavity drainage material.
6. Accessories embedded in masonry.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

B. Qualification Statements: For testing agency.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

D. Cold- and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
2. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of veneer, 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 face of veneer and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain exposed masonry units from single manufacturer.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including corners, movement joints, bond beams, sashes, and lintels, where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area), Grade SW, Type HBS.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Glen-Gery Corporation or comparable product by one of the following:

a. Acme Brick Company.
b. Belden Brick Company (The).
c. Boral Bricks, Inc; Boral Limited.
d. Endicott Clay Products Co.
e. General Shale, Inc.

2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
3. Effloresence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
4. Application: Use where brick is exposed unless otherwise indicated.
5. Where shown to "match existing, “provide clay face brick matching color range, texture, and size of existing adjacent brickwork.
6. Color and Texture: As selected by Architect.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Cement: ASTM C1329/C1329M.

E. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or mortar cement, mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
2. Pigments do not exceed 10 percent of portland cement by weight.
3. Pigments do not exceed 5 percent of mortar cement by weight.

F. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

C. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized steel wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
5. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie and washer at face of insulation.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Wire-Bond; Adjustable Veneer Anchor 2407 or comparable product by one of the following:

1) FERO Corporation.
2) Hohmann & Barnard, Inc.

6. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.
7. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless steel shank.

2.6 EMBEDDED FLASHING

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mil.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Wire-Bond; Aqua Flash 500 S.A. or comparable product by one of the following:

1) Advanced Building Products Inc.
2) Hohmann & Barnard, Inc.

b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

B. Solder and Sealants for Sheet Metal Flashings:

1. Elastomeric Sealant: ASTM C920, chemically curing sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

D. Termination Bars for Flexible Flashing: Stainless steel steel bars 1/8 inch by 1 inch.

2.7 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
2. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.
3. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Wire-Bond; Cell Vent 3601 or comparable product by one of the following:

        1) Advanced Building Products Inc.
        2) Hohmann & Barnard, Inc.

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Keene Building Products; KeeneStone Cut or comparable product by one of the following:

        1) Advanced Building Products Inc.
        2) Hohmann & Barnard, Inc.

2.8 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.

D. Pigmented Mortar: Use colored cement product.

1. Pigments do not exceed 10 percent of portland cement by weight.

2. Pigments do not exceed 5 percent of mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.

1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.

B. Set cast-stone trim units in full bed of mortar with full vertical joints.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 3.5 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

B. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

1. Provide not less than 1 inch of airspace between back of masonry veneer and face of insulation.

a. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints as follows:

1. Build in compressible joint fillers where indicated.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide offset angle supports where indicate and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
3. At lintels and shelf angles, extend flashing 6 inches minimum at each end. At heads and sills, extend flashing 6 inches minimum and turn ends up not less than 2 inches to form end dams.
4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.

D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches o.c. unless otherwise indicated.
4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
5. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections.

Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry 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 one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.

2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members.

C. Base plates, shear stud connectors.

D. Grouting under base plates.

1.2 RELATED REQUIREMENTS

A. Section 051213 - Architecturally-Exposed Structural Steel Framing: Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

B. Section 052100 - Steel Joist Framing.

C. Section 053100 - Steel Decking: Support framing for small openings in deck.

1.3 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

C. AISC 325 - Steel Construction Manual; 2017.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

J. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

N. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

O. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

P. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2018.

Q. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

R. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

S. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

T. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

V. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

W. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

X. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

Y. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

Z. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

AA. SSPC-SP 2 - Hand Tool Cleaning; 2018.

BB. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.5 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections not detailed.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.6 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 051213.

C. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M.

E. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

E. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

F. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.

G. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).

I. Shop and Touch-Up Primer: Fabricator's standard.

2.2 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Fabricate connections for bolt, nut, and washer connectors.

2.3 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.4 SOURCE QUALITY CONTROL

A. Welded Connections: Visually inspect all shop-welded connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts,."

C. Welded Connections: Visually inspect all field-welded connections and test as specified in testing schedules on structural drawings:

END OF SECTION

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SECTION 051213 - ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.2 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 099113 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

C. Section 099123 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.3 DEFINITIONS

A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.4 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

B. AISC 325 - Steel Construction Manual; 2017.

C. AISC 360 - Specification for Structural Steel Buildings; 2022.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2021.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

G. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS); 2015.

H. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi

Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

M. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

N. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site at least one week prior to start of work of this section; require attendance by all affected installers. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.

1.6 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product data for each type of product specified. Submit paint systems in accordance with Section 099113.

C. Shop Drawings: Detailing for fabrication of AESS components.

1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.
4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).
5. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.
6. Indicate special tolerances and erection requirements as noted on drawings or defined by the designated AESS category.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 051200, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

D. Owner to engage a quality assurance agency per requirements of AISC 360, Chapter N and AISC 303, Section 10.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with Section 051200, except as amended in this section for aesthetic purposes.

2.2 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Welded Connections:

1. Comply with AWS D1.1/D1.1M and Section 051200.
2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.

E. Fabricate AESS in accordance with categories defined in AISC 303, as follows:

1. AESS 2: Feature elements viewed at a distance greater than 20 feet (6 m) (feature elements not in close view).

2.3 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 099113 and 099123. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Primer: As specified in Sections 099113, 099123, and 099600. Primer to comply with all federal standards for VOC, lead and chromate levels.

C. Finish Coating: Field apply intermediate and top coats per Sections 099113 and 099123.

2.4 SHOP PRIMING

A. Surface Preparation:

1. Provide surface preparations to meet SSPC-SP 6.
2. Coordinate required surface profile with approved paint submittal prior to beginning surface preparation.
3. Prior to blasting, remove any grease and oil using solvent cleaning to meet SSPC-SP 1.
4. Remove weld spatter, slivers and similar surface discontinuities.
5. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.5 MATERIALS

A. General: Meet requirements of 051200.

2.6 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Structural Requirements:

1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 051200 for additional requirements.

C. AESS 1 and 2 Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

3.2 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.3 ERECTION

A. AESS 1 and 2: Basic elements; feature elements not in close view:

1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.
4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
6. Remove all backing and run out tabs.
7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.
8. Welded Connections: Comply with AWS D1.1/D1.1M and Section 051200. Appearance and quality of welds to be consistent. Employ methods that will maintain alignment of members without warp exceeding tolerance of this section.
9. Remove weld spatter exposed to view.
10. Grind off projections larger than 1/16 inch (1.5875 mm) at field butt and plug welds.
11. Continuous Welds: Where continuous welding is noted on drawings, provide continuous welds of a uniform size and profile.

12. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
13. Splice members only where indicated.
14. Obtain permission for any torch cutting or field fabrication from Architect. Finish sections thermally cut during erection to a surface appearance consistent with mock-up.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Structural Requirements:

1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 051200 for additional requirements.

C. AESS 1 and 2 Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

3.5 CLEANING

A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 099113 and 099123.

END OF SECTION

SECTION 052100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for roof openings greater than 12 inches.

1.2 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Superstructure framing.

B. Section 053100 - Steel Decking: Bearing plates, angles, and support framing for openings greater than 12 inches in decking.

C. Section 055000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

D. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

E. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

F. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

G. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2018.

H. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

I. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi

Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

M. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

N. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

O. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

Q. SSPC-SP 2 - Hand Tool Cleaning; 2018.

R. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Joists:

1. Canam Group Inc: www.canam-steeljoists.ws.
2. Nucor-Vulcraft Group: www.vulcraft.com/#sle.

2.2 MATERIALS

A. SJI Type K Joists:

1. Provide bottom chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
4. Finish: Shop primed.

B. SJI 100 Type LH Joists:

1. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
2. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
3. Finish: Shop primed.

C. SJI 100 Type DLH Joists:

1. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
2. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
3. Finish: Shop primed.

D. Anchor Bolts, Nuts and Washers: ASTM A307 plain.

E. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

F. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FINISH

A. Shop prime joists as specified.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.4 SOURCE QUALITY CONTROL

A. Welded Connections: Visually inspect all shop-welded connections in accordance with testing requirements given in drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).

F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

G. Do not field cut or alter structural members without approval of joist manufacturer.

H. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed, except surfaces specified not to be primed.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm).

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Welded Connections: Visually inspect all field-welded connections as per requirements given in drawings.

END OF SECTION

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SECTION 053100 - STEEL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Acoustical roof deck.

B. Roof deck.

C. Supplementary framing for openings up to and including 12 inches.

D. Bearing plates and angles.

E. Stud shear connectors.

F. Acoustical insulation in roof deck flutes.

1.2 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Support framing for openings larger than 12 inches and shear stud connectors.

B. Section 052100 - Steel Joist Framing: Support framing for openings larger than 12 inches and shear stud connectors.

C. Section 052100 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

F. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

G. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; 2022.

H. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; 2016.

I. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.4 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Certificates: Certify that products furnished meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Deck:

1. Canam Steel Corporation: www.canam-steeljoists.ws.
2. Nucor-Vulcraft Group: www.vulcraft.com/#sle.

2.2 STEEL DECK

A. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch (3 mm) diameter holes staggered 3/8 inch (10 mm) on center:

1. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
2. Minimum Base Metal Thickness: As indicated in structural drawings.
3. Nominal Height: As indicated in structural drawings.
4. Profile: As indicated in structural drawings.
5. Formed Sheet Width: As indicated in structural drawings.
6. Side Joints: As indicated in structural drawings.
7. End Joints: As indicated in structural drawings.

B. Roof Deck: Non-composite type, fluted steel sheet:

1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
3. Minimum Base Metal Thickness: As indicated in structural drawings.
4. Nominal Height: As indicated in structural drawings.
5. Profile: As indicated in structural drawings.
6. Side Joints: As indicated in structural drawings.
7. End Joints: As indicated in structural drawings.

C. Dovetail Roof Deck: Non-composite, fluted sheet type with specialized profile.

1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
3. Span Design: As indicated in structural drawings.
4. Minimum Base Metal Thickness: As indicated in structural drawings.
5. Nominal Height: As indicated in structural drawings.
6. Formed Sheet Width: As indicated in structural drawings.
7. Side Joints: As indicated in structural drawings.
8. End Joints: As indicated in structural drawings.

2.3 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.

B. Welding Materials: AWS D1.1/D1.1M.

C. Fasteners: Galvanized hardened steel, self-tapping.

D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

E. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft (18 kg/cu m) density; profiled to suit deck.

2.4 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gauge, 0.0359 inch (0.91 mm) thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch (1.90 mm) minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below roof deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.

C. Fasten deck to steel support members at ends and intermediate supports as specified in the structural drawings.

D. Mechanically fasten sidelaps as indicated in the structural drawings.

E. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

F. At deck openings greater than 12 inches in size, provide steel angle reinforcement. as specified in the structural drawings.

G. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Formed steel joist framing and bridging.

1.2 RELATED REQUIREMENTS

A. Section 042613 - Masonry Veneer: Veneer masonry supported by wall stud metal framing.

B. Section 053100 - Steel Decking.

C. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.3 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

J. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).

M. PS 1 - Structural Plywood; 2019.

N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.5 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Structural Framing:

1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. MarinoWARE: www.marinoware.com/#sle.
3. Steel Construction Systems: www.steelconsystems.com/#sle.
4. The Steel Network, Inc: www.SteelNetwork.com/#sle.

B. Connectors:

1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Simpson Strong-Tie: www.strongtie.com/#sle.

2.2 MATERIALS

A. Material and Product Requirements Criteria: AISI S201.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.3 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs, Jamb Studs, Headers, and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
2. Thickness, Width, and Depth: As indicated on the drawings;

B. Joists: AISI S240; manufactured c-shaped sections.

1. Structural Grade: As required to meet design criteria.
2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
3. Thickness and Depth: Thickness and depth as indicated on drawings.

2.4 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

2.5 SHEATHING

A. Floor Sheathing; PS-2, Exposure 1.

B. Gypsum Board Wall Sheathing: See Section 092116.

2.6 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

D. Water-Resistive Barrier: See Section 072500.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.2 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.3 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Splicing of studs is not permitted.

D. Install load-bearing studs; brace, and reinforce as indicated in the structural drawings.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

H. Attach cross studs to studs for attachment of fixtures anchored to walls.

I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

J. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.

3.4 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Space joists as indicate in the structural drawings.

C. Locate joist end bearing directly over load-bearing studs.

3.5 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

3.6 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide material verification inspections in accordance with requirements of AISI S240.

C. Provide inspections for welding, mechanical fastening, and cold-formed steel light-frame construction in accordance with requirements of AISI S240.

3.7 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft (3.2 mm in 3000 mm), in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch (3.2 mm) in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch (3.2 mm) from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION

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SECTION 055133 - METAL LADDERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal ladders.
2. Alternating tread devices.
3. Metal ships' ladders and pipe crossovers.

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

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

C. Related Requirements:

1. Section 077200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Manufactured metal ladders.
6. Alternating tread devices.
7. Metal ships' ladders and pipe crossovers.
8. Abrasive metal nosings, treads, and thresholds.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Metal ladders.
3. Alternating tread devices.
4. Metal ships' ladders and pipe crossovers.

C. Delegated Design Submittals: For ladders and alternating tread devices, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research Reports: For post-installed anchors.

E. Delegated design engineer qualifications.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

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."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders and alternating tread devices.

B. Structural Performance of Aluminum Ladders: Ladders, including landings, are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

C. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled-Stainless Steel Floor Plate: ASTM A793.

G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

I. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

J. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

K. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

L. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

M. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum or stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-

inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 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.

C. Galvanize miscellaneous framing and supports where indicated.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- 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. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
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 in least dimension.
8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanize and prime ladders, including brackets.

2.8 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. 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. Lapeyre Stair Inc.
b. Precision Ladders, LLC.

2. Tread depth is not to be less than 5 inches exclusive of nosing or less than 8-1/2 inches, including the nosing, tread width is not to be less than 7 inches, and riser height is not to be more than 9-1/2 inches.
3. Tread depth is not to be less than 8-1/2 inches exclusive of nosing or less than 10-1/2 inches, including the nosing, tread width is not to be less than 7 inches, and riser height is not to be more than 8 inches.
4. Fabricate from steel and assemble by welding or with stainless steel fasteners.
5. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."

B. Galvanize and prime steel alternating tread devices, including treads, railings, brackets, and fasteners.

2.9 METAL SHIPS' LADDERS AND PIPE CROSSOVERS

A. Provide metal ships' ladders and pipe crossovers where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Treads are not to be less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height is not to be more than 9-1/2 inches.
2. Fabricate ships' ladders and pipe crossovers, including railings from steel.
3. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch in least dimension.
4. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."

B. Galvanize and prime steel ships' ladders and pipe crossovers, including treads, railings, brackets, and fasteners.

2.10 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items 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.

D. Preparation for Shop Priming: Prepare surfaces to comply with 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.

2.12 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 INSTALLATION OF ALTERNATING TREAD DEVICES

A. Secure top and bottom of alternating tread devices to construction to comply with manufacturer's written instructions.

3.3 INSTALLATION OF METAL SHIPS' LADDERS AND PIPE CROSSOVERS

A. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.

B. Secure pipe crossovers to construction to comply with manufacturer's written instructions.

3.4 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel railings.

1.2 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 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.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Woven-wire mesh infill panels.
3. Fasteners.
4. Post-installed anchors.
5. Handrail brackets.
6. Shop primer.
7. Intermediate coats and topcoats.
8. Bituminous paint.
9. Nonshrink, nonmetallic grout.
10. Anchoring cement.
11. Metal finishes.
12. Paint products.

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

C. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, 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.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Tubing: ASTM A500/A500M (cold formed) orASTM A513/A513M, Type 5.

D. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

E. Plates, Shapes, and Bars: ASTM A36/A36M.

F. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

G. Woven-Wire Mesh Infill Panels: Intermediate-crimp, diamond pattern, 2-inch woven-wire mesh, made from 0.134-inch- diameter steel wire complying with ASTM A510.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
2. Finish exposed fasteners to match appearance, including color and texture, of railings.

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 and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron center of handrail 2-1/2 inches from face of railing.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

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. Intermediate Coats and Topcoats: Provide products that comply with Section 099123 "Interior Painting."

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. 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.

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. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. 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 are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. 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.

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 Finish #3 welds; utilitarian appearance not subject to view, partially dressed weld with spatter removed.

I. 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.

J. Form changes in direction as follows:

1. By bending or by inserting prefabricated elbow fittings.

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 cap and end fittings of same metal and finish as railings.

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 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.

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.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

Q. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames.

1. Fabricate wire mesh and frames from same metal as railings in which they are installed.
2. Orient wire mesh with wires perpendicular and parallel to top rail.

2.7 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip 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 3.

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

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 are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. 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.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. 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.

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.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch 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.

B. Cover anchorage joint with flange of same metal as post, attached to post with setscrews.

C. 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 steel railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with flanges connected to 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 connected to railing ends, using nonwelded connections.

C. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets 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 steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 REPAIR

A. Touchup Painting:

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

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.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Fire-retardant-treated lumber.
3. Miscellaneous lumber.
4. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.

4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. 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.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply 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 in accordance with ASTM E84, 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. Treatment is not to promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by 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 testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all rough carpentry unless otherwise indicated.

2.3 MISCELLANEOUS LUMBER

A. 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.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Northern species; No. 2 Common grade; NLGA.

D. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

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 A153/A153M or ASTM F2329.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.6 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. 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.
2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
3. Self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

J. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint-and-penetration treatment materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.
3. Section 075416 "Keytone Ethylene Ester (KEE) Roofing" for substrates and cover boards relating to sheathing of roofs.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing.
2. Sheathing joint-and-penetration treatment materials.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, including list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

D. Evaluation Reports: For the following, from ICC-ES:

1. Foam-plastic sheathing.
2. Air-barrier and water-resistant glass-mat gypsum sheathing.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

1. Installer is to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and is to employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.

a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC; Densglass or comparable product by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. USG Corporation.

2. Type and Thickness: Regular, 1/2 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

E. 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.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

F. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and 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 in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

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. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate 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.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. 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 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch 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. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners as indicated in drawings.

END OF SECTION

SECTION 061700 - ENGINEERED FRAMING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Engineered lumber framing systems for the following applications:

1. Parapet cap engineered framing system.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 07 54 16 - Ketone Ethylene Ester (KEE) Roofing.

1.3 REFERENCES

A. American Wood Protection Association (AWPA):

1. AWPA U1-15, UC2 Interior/Damp Use.

B. ASTM International (ASTM):

1. ASTM E 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus. (R-Value).

C. ICC Evaluation Service:

1. ICC-ES Report ESR-1387 -StrandGuard TimberStrand LSL 1.30E treated with zinc borate.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 30 00 - Administrative Requirements.

B. Product Data: Submit manufacturer's current published data including materials, standard details, and installation instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years' experience manufacturing similar products.

B. AWPA Standards: Materials shall meet AWPA U1-15 for Use Category UC 2. Service conditions for UC2 are interior construction, above ground, damp; protected from weather, but may be subject to sources of moisture.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials in accordance with manufacturer's recommendations and as required to avoid damage.

1.7 PROJECT CONDITIONS

A. Maintain temperature and humidity within limits recommended by the manufacturer. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: PreBuck, Web: http://www.prebuckproducts.com.

B. Substitutions: Not permitted.

2.2 PARAPET CAP ENGINEERED FRAMING SYSTEM

A. Parapet Cap Engineered Framing System: StrandGuard TimberStrand LSL 1.30E Engineered Lumber by PreBuck Engineered Framing Systems.

1. Meets AWPA U1-15 for Use Category 2 (UC2).
2. NAHB Research Center Green Approved.
3. MDI resin, 100 percent waterproof when cured.
4. Treated with zinc borate through complete cross section.
5. Typical material 1-1/2 inches (38 mm) thick; built-up as required.
6. Round 1-1/4 inch counter sunk anchor openings at 24 inches O.C.
7. Acceptable for direct contact with concrete, non-corrosive to metals, insect and fungi resistive.
8. Materials: StrandGuard TimberStrand LSL 1.30E Engineered Lumber, ICC ESR- 1387.

a. Treatment: Zinc borate through complete cross section.
b. Bending Strength: 1900 psi.
c. Tensile Strength: 1075 psi.
d. Shear Strength: 150 psi.
e. Compression - Perpendicular to Grain: 670 psi.
f. Specific Gravity: 0.50 into the face, 0.42 into the edge.
g. R-value of 1-1/2 inch thickness (ASTM E 518): 1.86.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's recommendations and in proper relationship with adjacent construction. Set members level, plumb, and true to line.

B. Coordinate construction sequence with installation of flashings and adjacent materials provided by others to prevent exterior moisture from entering or passing through completed assemblies.

C. Remove excess and waste materials from the job.

END OF SECTION

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SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

B. Product Data Submittals: For each product.

C. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

E. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Manufacturer of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart - New Age Oak 7954-38 or comparable product by one of the following:

a. Formica Corporation.
b. Pionite; a Panolam Industries International, Inc. brand.
c. Wilsonart LLC.

F. Exposed Surfaces:

1. Plastic-Laminate Grade: HGS.
2. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
3. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

G. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.

a. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.

2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Match Architect's sample.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Particleboard (Medium Density): ANSI A208.1, Grade M-2.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, 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. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

2.4 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

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. Accuride International Inc.
b. CompX International, Inc.
c. Grass America.
d. Hardware Resources.
e. Hettich America L.P.
f. Julius Blum & Co., Inc.
g. Knape & Vogt Manufacturing Company.

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening.

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: ANSI/BHMA A156.9, B04013; two-pin plastic with shelf hold-down clip.

G. Drawer Slides: ANSI/BHMA A156.9.

1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.

a. Type: Full extension.
b. Material: Epoxy-coated polymer slides.

2. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb load capacity.
3. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 75 lb load capacity.
4. File drawers more than 6 inches high or more than 24 inches wide, provide 100 lb load capacity.
5. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb load capacity.
6. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb load capacity.
7. Computer keyboard tray, provide 75 lb load capacity.

H. Door Locks: ANSI/BHMA A156.11, E07121.

I. Drawer Locks: ANSI/BHMA A156.11, E07041.

J. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

K. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: To be selected by Architect from Manufacturers full range.

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

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Molded (expanded) polystyrene foam-plastic board insulation.
3. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 072119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
2. Section 075416 "Keytone Ethylene Ester (KEE) Roofing" for insulation specified as part of roofing construction.
3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class B, 75 and 450 when tested in accordance with ASTM E84.

B. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

A. Extruded Polystyrene Board Insulation, Type X: ASTM C578, Type X, 15 psi minimum compressive strength; unfaced. For use in cavity-wall and foundation wall assemblies.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; Styrofoam Cavitymate or comparable product by one of the following:

a. Owens Corning.
b. The Dow Chemical Company.

B. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced. For below slabs-on-grade applications.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; Styrofoam Square Edge or comparable product by one of the following:

a. Kingspan Insulation LLC.
b. Owens Corning.

2.3 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EPS)

A. Molded (Expanded) Polystyrene Board Insulation, Type I: ASTM C578, Type I, 10 psi minimum compressive strength; unfaced. For use in Exterior Insulation and Finish Systems (EIFS).

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sto Corp.; Sto EPS Insulation Board or comparable product by one of the following:

a. Dryvit Systems, Inc.
b. Master Wall Inc.
c. Parex USA, Inc.

B. Source Limitations: Obtain EIFS insulation from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.4 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics. For use in framed stud-wall cavities.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; Formaldehyde-free Unfaced Fiberglass or comparable product by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Knauf Insulation.

2.5 INSULATION FASTENERS

A. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

B. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.6 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Miscellaneous Application Accessories:

1. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
2. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
3. Wire Mesh Lath Support for Insulation: ASTM C1032.

a. Material: Woven wire lath 1-1/2-inch hexagonal-shaped mesh with minimum 0.0510-inch- diameter, galvanized-steel wire.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

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. Install insulation with manufacturer's R-value label exposed after insulation is installed for any insulation type not covered in the Installer's Certification Information Submittals.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 48 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended in writing by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

3.7 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

B. Related EIFS requirements specified in Section 072413 “Polymer-Based Exterior Insulation and Finish System (EIFS)”.

3.8 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam insulation.
2. Open-cell spray polyurethane foam insulation.
3. Accessories.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Closed-cell spray polyurethane foam insulation.
2. Accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by qualified testing agency.

B. Field quality-control reports.

C. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

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

a. Flame-Spread Index: 75 or less.

b. Smoke-Developed Index: 450 or less.

2. Fire Propagation Characteristics: Passes NFPA 285,and,NFPA 276 testing as part of an approved assembly.

2.2 ACCESSORIES

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

B. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.

1. Gypsum Wallboard: 0.5-inch minimum thickness.
2. Materials tested in accordance with and complying with acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

C. Ignition Barrier: Material providing a 15-minute minimum fire-ignition barrier.

1. Mineral-Fiber Insulation: 1.5-inch minimum thickness.
2. Wood Structural Panel, Particleboard or Hardboard: 0.25-inch minimum thickness.
3. Gypsum Wallboard: 0.325-inch minimum thickness.
4. Corrosion-Resistant Steel: 0.016-inch base metal thickness.
5. Cellulose Insulation: 1.5-inch minimum thickness, self-supported spray-applied; for attic spaces only.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Miscellaneous Voids: Apply according to manufacturer's written instructions.

E. Install thermal barrier material.

1. Do not cover insulation prior to any required spray foam insulation inspections.

F. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect spray foam insulation installation, including accessories. Report results in writing.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

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SECTION 072413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Polymer-based exterior insulation and finish system (EIFS).

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

B. Related Requirements:

1. Section 072100 “Thermal Insulation” for foam-plastic board insulation.
2. Section 072726 "Fluid-Applied Membrane Air Barriers" for fluid-applied, synthetic polymer air barriers applied over sheathing behind EIFS-clad wall assemblies.

1.2 DEFINITIONS

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. IBC: International Building Code.

D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E2568.

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of exposed accessories involving color selection.

C. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including an aesthetic reveal.

1. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:

1. EIFS substrate is acceptable to EIFS manufacturer.

C. Product Certificates: For insulation, from manufacturer.

D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

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

1. 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.
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. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be

applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.9 WARRANTY

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

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following EIFS components:

a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
b. Insulation installed as part of EIFS, including buildouts.
c. Insulation adhesive and mechanical fasteners.
d. EIFS accessories, including trim components and flashing.

3. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sto Corp.; StoTherm ci or comparable product by one of the following:

1. Dryvit Systems, Inc.
2. Master Wall Inc.
3. Parex USA, Inc.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to water penetration from exterior.
2. Structural Performance of Assembly and Components:

a. Wind Loads:

1) Uniform pressure as indicated on Drawings.

3. Impact Performance: ASTM E2568, Impact resistance ratings as follows.

a. Up to 4 Feet Above Finished Floor: Use ultra-high impact mesh.
b. 4 Feet to 8 Feet Above Finished Floor: Use high impact mesh.
c. Over 8 Feet Above Finished Floor: Use standard impact mesh.

2.3 EIFS MATERIALS

A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

B. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:

1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
2. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

C. Molded (Expanded) Polystyrene Foam-Plastic Board Insulation: Comply with ASTM E2430/E2430M, Section 072100 “Thermal Insulation,” and the following:

1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, in accordance with ASTM E84.
2. Dimensions: Provide insulation boards of not more than 24 by 48 inches, with thickness indicated on Drawings.

D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. in accordance with ASTM E2098/E2098M and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
2. Strip-Reinforcing Mesh: Not less than As recommended by EIFS manufacturer.
3. Detail-Reinforcing Mesh: Not less than As recommended by EIFS manufacturer.
4. Corner-Reinforcing Mesh: Not less than As recommended by EIFS manufacturer.

E. Base Coat: EIFS manufacturer's standard mixture complying with one of the following:

1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

F. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners, consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed

to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:

1. For attachment to steel studs from 0.033 to 0.112 inch in thickness, provide steel drill screws complying with ASTM C954.
2. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.

G. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

H. Finish Coat: EIFS manufacturer's standard acrylic-based coating complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Colors: As selected by Architect from manufacturer's full range.
3. Textures: As selected by Architect from manufacturer's full range.

I. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

J. Water: Potable.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

2.5 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections indicated below and to prepare test reports:

1. Shop welds are subject to testing and inspection.
2. Testing and inspecting agency will interpret tests and report whether tested Work complies with or deviates from requirements.
3. Correct deficiencies in or replace EIFS prefabricated panels that test reports and inspections indicate do not comply with requirements.
4. Additional testing and inspection, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

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 roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 INSTALLATION OF EIFS, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 APPLICATION OF SUBSTRATE PROTECTION

A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 INSTALLATION OF INSULATION

A. Board Insulation: Adhesively and mechanically attach insulation to substrate in compliance with ASTM C1397 and the following:

1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch for factory mixed and not less than 3/8 inch for field mixed, measured from surface of insulation before placement.

2. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
4. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

    a. Steel Framing: 5/16 inch.

5. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
6. Begin first course of insulation from a level base line and work upward.
7. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.

    a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
    b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

8. Interlock ends at internal and external corners.
9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
13. Interrupt insulation for expansion joints where indicated.
14. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
15. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
16. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.

17. Treat exposed edges of insulation as follows:

    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
    c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

18. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.
5. Where panels abut one another.

3.6 APPLICATION OF BASE COAT

A. Water-Resistant Base Coat: Apply full-thickness coverage to exposed insulation and to exposed surfaces of sloped shapes, windowsills, parapets, foam buildouts and to other surfaces indicated on Drawings.

B. Base Coat: Apply full coverage to exposed insulation with not less than 1/16-inch dry-coat thickness.

C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.

E. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches wide.
2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

F. Foam Buildouts: Fully embed reinforcing mesh in base coat.

G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.7 APPLICATION OF FINISH COAT

A. Primer: Apply over dry base coat.

B. Finish Coat: Apply full-thickness coverage over dry base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.8 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

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

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. EIFS Tests and Inspections: In accordance with ASTM E2568.

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

E. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

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SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Medium-build air barriers, vapor retarding.

B. Related Requirements:

1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 ACTION SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

1. Medium-build air barriers, vapor permeable.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies must comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate in accordance with ASTM E783.
2. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate in accordance with ASTM D4541.
3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain primary air-barrier materials and air-barrier accessories from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested in accordance with ASTM E2357.

C. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference; ASTM E2178.

D. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.

E. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested in accordance with ASTM D4541.

F. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR RETARDING

A. Medium-Build, Vapor-Retarding Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 16 to 34 mils over smooth, void-free substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco CGP, Inc.; ExoAir 120 or comparable product by one of the following:

a. PROSOCO, Inc.
b. Sto Corp.

2. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Procedure A, Desiccant Method.

2.4 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid primer recommended for substrate by air-barrier material 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 Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method in accordance with ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF ACCESSORIES

A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 INSTALLATION OF PRIMARY AIR-BARRIER MATERIAL

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Retarding, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with ASTM E783.
2. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

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SECTION 075416 - KETONE ETHYLENE ESTER (KEE) ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic KEE roofing system on metal deck, including:
2. Substrate board.
3. Roof insulation.
4. Roof insulation cover board.
5. Walkway material.

B. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking."

C. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for shop-formed sheet metal items including roof drainage system items, roof penetration flashings, base and counterflashings and reglets, and formed copings and roof edge metal items.

D. Alternates: Refer to Division 01 Section "Alternates" for description of Work in this Section affected by alternates.

E. Unit Prices: Refer to Division 01 Section "Unit Prices" for description of Work in this Section affected by unit prices.

1.2 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's Consultant, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review drawings and specifications.
3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

5. Examine substrate conditions and finishes for compliance with requirements, including flatness and fastening.
6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.

a. Indicate details meet requirements of NRCA and FMG required by this Section.

2. Tapered insulation, including slopes and crickets.
3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.5 INFORMATIONAL SUBMITTALS

A. Warranties: Unexecuted sample copies of special warranties.

B. Inspection Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.

1. Submit reports within 48 hours after inspection.

1.6 CLOSEOUT SUBMITTALS

A. Executed copies of warranties.

B. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this

Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site access to manufacturer's written recommendations and instructions for installation of products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT / FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
3. Remove temporary plugs from roof drains at end of each day.
4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.10 WARRANTY

A. Manufacturer's Warranty: Roof System Manufacturer's standard form in which Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within warranty period, as follows.

1. Form of Warranty: Manufacturer's standard warranty form.
2. Scope of Warranty: Work of this Section and including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.
3. Warranty Period: 30 years from date of completion.

a. Alternate Bid warranty period: 20 years from date of completion.

B. Manufacturer Inspection Services: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's inspections is included in the Contract Sum.

1. Inspections to occur in following years: 2, 5, 10, 15, 20 and 25 following completion.

a. Alternate Bid inspections to occur in following years: 2, 5, 10 & 15 following completion.

C. Installer Warranty: Installer's warranty signed by Installer, as follows.

1. Infrared roof scan to be completed 1-year after substantial completion.
2. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.
3. Scope of Warranty: Work of this Section.
4. Warranty Period: 2 years from date of completion.

a. 5 years for cold welds.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The roof system specified in this Section is based upon products of Tremco CPG Inc, Beachwood, OH, (800) 562-2728, www.tremcoroofing.com that are named in other Part 2 articles. Provide specified products.

1. The owner has selected project procurement via a previously competed national service cooperative contract. For any questions pertaining to project procurement contact Ryan Palmer at rpalmer@tremcoinc.com.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency in accordance with ANSI/FM 4474, UL 580, or UL 1897, and to resist uplift pressures calculated in accordance with ASCE-7 and applicable code.

1. Roofing system shall meet or exceed the requirements of NFPA 276/ FM 4450 and UL 1256.

C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to ANSI/SPRI ES-1.

D. Flashings and Fastening: Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:

1. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.
2. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.
3. Comply with requirements of Division 07 Section "Sheet Metal Flashing and Trim".

E. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

2.3 MATERIALS, GENERAL

A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

2.4 THERMOPLASTIC MEMBRANE MATERIALS

A. KEE Roof Membrane:

1. Thermoplastic Ketone Ethylene Ester (KEE) coated polyester fabric-reinforced fleece-backed sheet, ASTM D6754.

a. Basis of design product: Tremco, TremPly KEE FB Single Ply Roof Membrane.
b. Breaking Strength, minimum, ASTM D751: Machine direction, 500 lbf (87 kN/m); Cross machine direction 400 lbf (70 kN/m).
c. Tear Strength, minimum, ASTM D751: Machine direction, 125 lbf (22 kN/m); Cross machine direction (145 lbf (25 kN/m).

d. Elongation at Break, ASTM D751: 20 percent.
e. Dynamic Impact/Puncture Resistance, ASTM D5635: 30 J, minimum.
f. Minimum Membrane Thickness, nominal, less backing, ASTM D751: 60 mils (1.5 mm).

1) Alternate Bid: 45 mils (1.1mm).

g. Accelerated Weathering, ASTM G155 and ASTM G154: Not greater than 15,000 hr., no cracking or crazing.
h. Abrasion Resistance, ASTM D3389: Not greater than 2,000 cycles, H-18 wheel, 1,000 g load.
i. Color: White.

B. Sheet Flashing: Manufacturer's standard, smooth-backed, sheet flashing of same material, type, reinforcement, thickness and color as KEE roof membrane.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Membrane Bonding Adhesive:

1. Bonding adhesive, waterborne low-VOC, for bonding KEE fleece-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE FB WBII Bonding Adhesive.
b. VOC, maximum, ASTM D3960: 153 g/L.

C. Flashing Membrane Adhesive:

1. Bonding adhesive, solvent based fast drying, VOC-compliant, for bonding KEE smooth-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE LV Bonding Adhesive.
b. VOC, maximum, ASTM D 3960: 200 g/L.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 mm by 3 mm) thick; with anchors.

E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to membrane roofing system manufacturer.

G. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

a. Basis of design product: Tremco, TremSEAL Pro.
b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.
c. Hardness, Shore A, ASTM C661: 40.
d. Adhesion to Concrete, ASTM C794: 35 pli.
e. Tensile Strength, ASTM D412: 350 psi (2410 kPa).
f. Color: Closest match to substrate.

H. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.6 SUBSTRATE BOARDS

A. Gypsum panel, Type X, ASTM C1396/C1396M.

1. Basis of design product: Gypsum panel, Type X.
2. Thickness: 5/8 inch (15.87 mm) thick.

2.7 ROOF INSULATION MATERIALS

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from insulation manufacturer's standard sizes, suitable for application, and of thicknesses indicated.

1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.

B. Roof Insulation: Provide roof insulation product in thicknesses indicated in Part 3 as follows:

1. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.

a. Basis of design product: Tremco, Trisotech Insulation.
b. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).
c. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

2.8 ROOF INSULATION ACCESSORIES

A. Cover Board (Base Bid):

1. Gypsum panel, glass-mat-faced, primed, ASTM C1177/C1177M.

    a. Basis of design product: Tremco/GP Gypsum DensDeck Prime.
    b. Thickness: 1/4 inch (6 mm).

2. Roof C3 will receive a coverboard in both the base bid and the alternate bid.

B. Coverboard Adhesive (Base Bid):

1. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.

    a. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.
    b. Flame Spread Index, ASTM E84: 10.
    c. Smoke Developed Index, ASTM E84: 30.
    d. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.
    e. Tensile Strength, minimum, ASTM D412: 250 psi (1720 kPa).
    f. Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.50 kN/m).
    g. Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

E. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

F. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

2.9 WALKWAY MATERIALS

A. Walkway / Protection Mat Material:

1. Protection walkway roll, reinforced KEE membrane roll with diamond-tread, slip-resistant surface, fabricated for heat welding to compatible KEE membrane surface.

    a. Basis of design product: Tremco, TremPly KEE Protection Walkway Roll.
    b. Roll Size: 30 inches by 100 ft (760 mm by 25.4 m).
    c. Thickness: 0.060 inch (1.5 mm).
    d. Breaking strength: 450 lbs (77 kN/m).
    e. Color: Yellow.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Steel Roof Deck:

    a. Verify that deck is securely fastened and properly supported with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer’s written instructions and approved details.

B. Install wood cants, blocking, curbs, and nailers in accordance with requirements of Division 06 Section "Miscellaneous Rough Carpentry."

C. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details and perimeter fastening requirements of FM Global references if applicable.

3.4 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Loosely lay substrate board to deck and secure using mechanical fasteners subsequently installed to secure other layers of roof system.
2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.5 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Tapered Insulation and Crickets: Install tapered insulation under area of roofing to conform to slopes indicated.

1. Where crickets are indicated or required to provide positive slope to drain, make slope of crickets minimum of two times the roof slope, not less than 1/4 inch in 12 inches (1:48).

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (70 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

1. Insulation Drain Sumps: Tapered insulation sumps, not less than 2 by 2 ft. (600 by 600 mm), sloped to roof drain; sump to maximum depth of not more than 1 inch (25 mm) less than the Project-stipulated continuous insulation thickness based upon code requirements.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

H. Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together.

1. Secure cover boards to resist uplift pressure at corners, perimeter, and field of roof.
2. Adhere cover boards by setting in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover board in place.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Water-Based Bonding Adhesive: Apply to substrate at rate required by manufacturer. Install membrane immediately into adhesive, avoiding any air entrapment; do not allow adhesive to dry. Roll membrane into wet adhesive. Do not apply adhesive to splice area of membrane.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Welded Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition. Install in such a manner as to not void warranty for existing membrane roofing system.

3.7 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Seal top termination of base flashing with a metal termination bar and a continuous bead of joint sealant.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Roofing Inspector: Contractor shall engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.

B. Engage a qualified roofing inspector to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with applicable criteria established in NRCA's "Quality Control and Quality- assurance Guidelines for the Application of Membrane Roofing Systems."

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

D. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

E. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Owner's Consultant and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition

free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 042613 "Masonry Veneer" for materials and installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
3. Section 076300 "Sheet Metal Roofing Specialties" for materials and installation of sheet metal flashing and trim integral with roofing.
4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Qualification Statements: For fabricator.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

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

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. Nominal Thickness: 0.028 inch.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:

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

4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

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

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

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

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

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

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

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

B. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend beyond wall openings.

3.4 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean off excess sealants.

3.6 PROTECTION

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

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 076300 - SHEET METAL ROOFING SPECIALTIES

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. Work Results:

B. Principal Products:

C. This Section includes the following sheet metal flashing and trim:

1. Formed wall flashing and trim.
2. Sheet metal coping.
3. Counter flashing and reglets.

1.3 PERFORMANCE REQUIREMENTS

A. All sheet metal flashing and trim must be installed per ANSI/SPRI ES-1 requirements.

B. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress because of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Meet with Owner, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
3. Exposed Finishes: Apply the following coil coating:

a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.

1) Color: As selected by owner from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. High temperature self-adhering underlayment.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

E. Burning Rod for Lead: Same composition as lead sheet.

F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

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

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

I. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

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

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.

1. Fabricate parapet scuppers from the following material:

a. KEE Roof - PVC coated metal (riveted and sealed).

B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg. Options in first subparagraph below represent middle range of styles recognized by SMACNA. Revise to suit Project. Add descriptions here or show special corner and edge styles on Drawings if required.

1. Joint Style: slip and drive at corners and butt joints.

C. Counterflashing: Fabricate from the following material:

1. Prepainted, Metallic-Coated Steel: 24 gauge.

D. Flashing Receivers: Fabricate from the following material:

1. Prepainted, Metallic-Coated Steel: 24 gauge.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
2. Bed flanges in thick coat of SBS modified asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than.

I. 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

1. Prepare joints and apply sealants.

J. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

K. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

L. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 20-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing to the toe of the cant. Utilize S-style keepers at the laps.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing.

D. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof hatches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated.

B. Shop Drawings: For roof accessories.

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

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

1. Powder-Coat Finish: Manufacturer's standard powder coat finish.

B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

C. Clamps: 6061-T6 aluminum extrusions, Pipe Brackets: 5000 Series alloy aluminum, Pipes: 6005a-T61 Series aluminum alloy and miscellaneous hardware for system install.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

D. Sealants: As recommended by roof accessory manufacturer for installation indicated.

2.3 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Babcock-Davis.
    b. Bilco Company (The).
    c. J. L. Industries, Inc.
    d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    e. Nystrom.
    f. O'Keeffe's Inc.
    g. or approved manufacturer.

B. Roof Access Hatch - Type and Size: 30 by 54 inches.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Insulation: Polyisocyanurate board.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.

6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 inches.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Seal joints with sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Penetration firestopping systems.

1. Penetration firestopping systems in fire-resistance-rated walls.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for non-fire-resistance-rated joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

C. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJs.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) recommended guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Entity that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL Solutions and found to comply with "UL Solutions Qualified Firestop Contractor Program."

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping system materials in accordance with manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be accessed and installed in accordance with specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration firestopping systems must be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Penetration firestopping systems must be installed with products bearing the classification marking of a qualified testing agency.

a. UL Solutions in its online directory "Product iQ."
b. Intertek Group in its "Directory of Building Products."
c. FM Approvals in its "Approval Guide."

2. Provide components for each penetration firestopping system that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.

3. Provide components for each penetration firestopping system that do not contain ethylene glycol.
4. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.
5. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

B. Provide penetration firestopping systems that resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

C. Penetration Firestopping Systems in Fire-Resistance-Rated Walls: Systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of the wall assembly penetrated.
2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

2.3 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.4 FILL MATERIALS

A. Cast-in-Place Firestopping Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestopping Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.

F. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

G. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

H. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.

I. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.

1. Fire-rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:

a. Capable of retrofit around existing cables.
b. Designed so that two or more devices can be ganged together.
c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.

2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.

J. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

K. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

L. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.

M. Firestopping Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

N. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch (13 mm) in diameter.

O. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:

1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

A. General: Install penetration firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications.

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 forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. (4.57 m) from end of wall and at intervals not exceeding 30 ft. (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified inspection agency to conduct and report on inspections in accordance with ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems 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 system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Urethane joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. 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.

1.3 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.6 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: 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: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those 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.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from 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 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type 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.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. 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.
    d. Exterior insulation and finish systems.

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. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type 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 in accordance with 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

a. Extent of Testing: Test completed and cured sealant joints as follows:

1) Perform 10 tests for the first 1000 ft. of joint length for each kind of sealant and joint substrate.
2) Perform one test for each 1000 ft. of joint length thereafter or one test per each floor per elevation.

b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

c. Inspect tested joints and report on the following:

1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) 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 complies with sealant manufacturer's field-adhesion hand-pull test criteria.

d. 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 material, sealant configuration, and sealant dimensions.
e. 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.

2. 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.

C. Prepare test and inspection reports.

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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

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SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Exterior expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Expansion Joint Cover Assembly 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 joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.
7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

PART 2 PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 EXTERIOR EXPANSION JOINT COVERS

A. Preformed Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, provide EMSEAL; Colourseal or comparable product by one of the following:

    a. Balco; a CSW Industrials Company.
    b. Willseal LLC, part of Tremco CPG.

2. Design Criteria:

    a. Nominal Joint Width: As indicated on Drawings.

3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.3 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.

1. Provide where indicated on Drawings.

B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

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.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Install frames in continuous contact with adjacent surfaces.

    a. Shimming is not permitted.

5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Elastomeric Seals: 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. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.

1. Install each length of seal immediately after removing protective wrapping.

2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

H. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 CONNECTIONS

A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 077129 "Manufactured Roof Expansion Joints."

3.5 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.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

C. 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 electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

D. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

E. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

F. Product Schedule: For hollow-metal doors and frames, 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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly, and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames 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 doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

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. Apex Industries, Inc.
2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. DCI Hollow Metal on Demand.
4. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

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

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: 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 in accordance with NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.37 deg Btu/F x h x sq.ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule on Drawings.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

C. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations that open into or exit from the Shop.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule on Drawings.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

C. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations that open into or exit from the Shop.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

A. At locations indicated to receive Extra-Heavy-Duty Doors or Frames, fabricate of metallic-coated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. 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.

F. Mineral-Fiber Insulation: ASTM C665, 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 E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. 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.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted ormitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
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. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

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 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: 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.

4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

A. 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.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.
2. Solid-core five-ply flush wood doors and transom panels for opaque finish.
3. Light frames.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.
2. Light frames.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Door edge construction.
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory-finishing specifications.

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

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

D. Samples for Initial Selection: For factory-finished doors.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Basis-of-Design Product: Subject to compliance with requirements, provide VT Industries, Inc.; Heritage Collection or comparable product by one of the following:

    a. Lynden Door, Inc.
    b. Masonite Architectural.

2. Compliance: ANSI/WDMA I.S. 1-A.

    a. Aesthetic Grade: Custom.
    b. Duty Level: Heavy Duty.

3. Faces: Single-plywood veneer not less than 1/50 inch thick.

    a. Species: Red oak.
    b. Cut: Rift Sliced.
    c. Match between Veneer Leaves: Slip match.
    d. Assembly of Veneer Leaves on Door Faces: Running match.
    e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    f. Room Match:

        1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
        2) Provide door faces of compatible color and grain within each separate room or area of building.

4. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors:

        1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

    c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

5. Core for Non-Fire-Rated Doors:

    a. ANSI A208.1, Grade LD-2 particleboard.

1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."

b. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Species compatible with door faces.
2. Profile: Flush rectangular beads.

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

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Custom.

a. TR-6 Catalyzed Polyurethane.

2. Staining: None.
3. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

2. Anchor frames to anchors or blocking built in or directly attached to substrates.

    a. Secure with countersunk, concealed fasteners and blind nailing.
    b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

        1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof hatches.
2. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
2. Locations: Wall and ceiling.
3. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
4. Frame Material: Same material and thickness as door.
5. Latch and Lock: Cam latch, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Self-closing, self-latching door hardware, operated by key.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

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. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 083313 - COILING COUNTER DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Counter door assemblies.

B. Related Requirements:

1. Section 123661.19 “Quartz Agglomerate Countertops” for counters used with coiling counter doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Include similar Samples of accessories involving color selection.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain coiling counter doors from single source from single manufacturer.

1. Obtain operators and controls from coiling counter door manufacturer.

2.2 COUNTER DOOR ASSEMBLY

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide C.H.I. Overhead Doors, Inc.; 6500 Series or comparable product by one of the following:

a. Clopay Building Products.
b. Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Door Curtain Material: Aluminum.

D. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated aluminum extrusion and finished to match door.

F. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.

1. Shape: Square.
2. Mounting: Face of wall.

H. Sill Configuration: See Section 123661.19 “Quartz Agglomerate Countertops.”.

I. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Cremone-type, both jamb sides locking bars, operable from inside with thumbturn.

J. Manual Door Operator: Manufacturer's standard crank operator.

K. Door Finish:

1. Aluminum Finish: Clear anodized.

2.3 MATERIALS, GENERAL

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.

2.4 DOOR CURTAIN MATERIALS AND FABRICATION

A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Aluminum Door Curtain Slats: ASTM B209 sheet or ASTM B221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch; and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040-inch- thick aluminum sheet complying with ASTM B209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

2.6 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: As specified in Section 087100 "Door Hardware" and keyed to building keying system.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.

3.5 DEMONSTRATION

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

END OF SECTION

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SECTION 083613 - SECTIONAL DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

C. Finish warranty.

1.5 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with provisions in the ICC A117.1 applicable to sectional doors.

1.6 WARRANTY

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

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.

2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

    a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
    b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

2.3 INSULATED SECTIONAL-DOORS (SD1):

A. Sectional Door: Provide steel sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

1. Basis-of-Design Product: Subject to compliance with requirements, provide C.H.I. Overhead Doors, Inc.: 3200 Series Insulated Sandwich Doors or comparable product by one of the following:

    a. Clopay Building Products.
    b. Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. U-Value: Maximum value of 0.42 Btu/sq.ft. x h x deg F.

E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 zinc coating.

1. Door-Section Thickness: 2 inches.
2. Section Faces:

    a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
    b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.

        1) Steel Sheet Thickness: 0.019-inch nominal coated thickness.
        2) Surface: Manufacturer's standard, flat.

    c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:

1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of dimension recommended in writing by manufacturer to comply with performance requirements.

3. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.

   a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
   b. Hardware Locations: Provide reinforcement for hardware attachment.

4. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:

   a. Board Insulation: Polystyrene or polyurethane, secured to exterior face sheet.
   b. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
   c. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.

5. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:

   a. Manufacturers' standard insulating glass unit with tempered lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.

2.4 FULL-VIEW SECTIONAL-DOORS (SD2):

A. Sectional Door: Provide steel sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

   1. Basis-of-Design Product: Subject to compliance with requirements, provide C.H.I. Overhead Doors, Inc.: 3295 Series Full-View Aluminum Doors or comparable product by one of the following:

      a. Clopay Building Products.
      b. Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Aluminum Sections: ASTM B221 extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; in minimum thickness required to comply with requirements; with rail and stile dimensions and profiles indicated on

Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.

1. Door-Section Thickness: 2 inches.
2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.

    a. Hardware Locations: Provide reinforcement for hardware attachment.

3. Insulated Stiles and Rails: Fill stiles and rails manufacturer's standard polyurethane expanding foam.
4. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:

    a. Manufacturers' standard unit with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.

2.5 COMPONENTS

A. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

    a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous reverse angle attached to track and wall.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top, and jambs of door.

C. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

    a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
    b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

    a. Roller-Tire Material: Manufacturer's standard.

D. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

E. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
3. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

F. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
4. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
5. Operator Type: Manufacturer's standard for door requirements.
6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.

    a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
    b. Electrical Characteristics:

        1) Phase: Single phase.
        2) Volts: 120 V.

7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

a. Monitored Entrapment Protection: Electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.

9. Control Station: Surface mounted, three-position (open, close, and stop) control.

a. Operation: Key.
b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
c. Features: Provide the following:

1) Audible and visual signals that comply with regulatory requirements for accessibility.

10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.6 FINISHES

A. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

a. Aluminum Finish: Comply with AAMA 2603 requirements for pigmented organic coatings applied to aluminum extrusions and panels.
b. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

3.5 DEMONSTRATION

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

END OF SECTION

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.
2. Storefront-anchored sunshade systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:

    a. Power requirements for each electrically operated door hardware.
    b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

6. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

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

E. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.

B. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by a qualified testing agency.

C. Source Quality-Control Reports: For aluminum-framed entrance and storefront systems.

D. Delegated Design Engineer Qualifications: For aluminum-framed entrance and storefront systems.

E. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Egress Door Inspector Qualifications:

1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."

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.

1.6 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrances, storefront systems, and sunshades including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance and storefront systems.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, 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: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches and to 1/240 of length of span of the framing member plus 1/4 inch for lengths greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and 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. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq.ft.

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

    a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.34 Btu/sq.ft. x h x deg F as determined in accordance with NFRC 100.
    b. Entrance Doors: U-factor of not more than 0.63 Btu/sq.ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

    a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.38 as determined in accordance with NFRC 200.
    b. Entrance Doors: SHGC of not more than 0.34 as determined in accordance with NFRC 200.

3. Air Leakage:

    a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.

b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 60 as determined in accordance with AAMA 1503.
b. Entrance Doors: CRF of not less than 63 as determined in accordance with AAMA 1503.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

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

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Company, Inc.; Trifab VersaGlaze 451T or comparable product by one of the following:

1. Tubelite Inc.
2. YKK AP America Inc.

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

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Glazing Plane: Front.
5. Finish: Clear anodic finish.
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Medium stile; 3-1/2-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

4. Finish: Match adjacent storefront framing finish.

2.4 STOREFRONT-ANCHORED SUNSHADE SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Company, Inc.; Versoleil SunShade Outrigger System or comparable product by one of the following:

1. Tubelite Inc.
2. YKK AP America Inc.

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

1. Exterior Framing Construction: Thermally broken.
2. Finish: Match adjacent storefront framing finish.

C. Sunshade Blades: Manufacturer's standard extruded or formed-aluminum framing members of thickness and reinforced as required to support imposed loads.

1. Finish: Match adjacent storefront framing finish.
2. Extrusion Profile: As selected by Architect from manufacturer's full range.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.

D. Removable Mullions: BHMA A156.3 extruded aluminum.

1. When used with panic exit devices, provide keyed removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305. Use only mullions that have been tested with exit devices to be used.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.7 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: 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 in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.8 ACCESSORIES

A. Automatic Door Operators: Section 087113 "Power Door Operators."

B. 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.

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch 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 A123/A123M or ASTM A153/A153M requirements.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

F. Rigid PVC filler.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

E. 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.

F. 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.

G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.10 ALUMINUM FINISHES

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

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 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. 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.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install entrance 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 in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

L. Install glazing as specified in Section 088000 "Glazing."

3.3 ERECTION TOLERANCES

A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections.

B. Inspections:

1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."

C. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

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.

END OF SECTION

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SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Glazed aluminum curtain wall systems:

1. Conventionally glazed.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
2. Section 088000 "Glazing" for curtain wall glazing.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. 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 type of vertical-to-horizontal intersection of glazed aluminum curtain walls, 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. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch 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.

D. Delegated Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

B. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 MOCKUPS

A. 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. 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 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall 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, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 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 glazed aluminum curtain walls.

B. 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.
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: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches and to 1/240 of length of span of the framing member plus 1/4 inch for lengths of greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.34 Btu/sq.ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.38 as determined in accordance with NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 60 as determined in accordance with AAMA 1503.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

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

2.2 SOURCE LIMITATIONS

A. Obtain all components of curtain-wall system and storefront system, including framing entrances sun control and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Company, Inc.; 1600UT System 1 Curtain Wall or comparable product by one of the following:

1. Tubelite Inc.
2. YKK AP America Inc.

B. 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. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. System: Stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Entrance Door Systems: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts".

2.4 SUN CONTROL

A. Sunshade Systems: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts".

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard.

1. Color: Black.

C. Glazing Sealants: As recommended by manufacturer.

2.6 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: 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 in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.7 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, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch 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 A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.8 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 with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

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

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 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.4 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.

3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 087100 - DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Bored locks.
3. Mortise locks.
4. Electric strikes.
5. Electromechanical locks.
6. Manual flush bolts.
7. Exit devices and auxiliary items.
8. Lock cylinders.
9. Operating trim.
10. Surface closers.
11. Concealed closers.
12. Wall- and floor-mounted stops.
13. Overhead stops and holders.
14. Electromagnetic door holders.
15. Door gasketing.
16. Thresholds.
17. Metal protective trim units.
18. Auxiliary door hardware.
19. Auxiliary electrified door hardware.

B. Related Requirements:

1. Section 083113 "Access Doors and Frames" for access door hardware, except cylinders.
2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware not included in this section such as removable mullions.
3. Section 087113 "Power Door Operators" for low-energy power operators and low-energy power-assist operators.
4. Section 102213 "Wire Mesh Partitions" for door hardware for doors in wire mesh partitions, except cylinders.

1.2 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field-verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 PREINSTALLATION MEETINGS

A. Keying Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

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 electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule after, or concurrent with, submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

E. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.7 QUALITY ASSURANCE

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

1. Warehousing Facilities: In Project's vicinity.

2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as a Door and Hardware Specification Consultant (DHSC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that

are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

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

1. Basis-of-Design Product: Subject to compliance with requirements, provide IVES (Allegion plc); 5PB1/5PB1HW or comparable product by one of the following:

    a. Hager Companies.
    b. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.
    c. STANLEY; dormakaba USA, Inc.

2. Quantity: Unless otherwise specified, furnish the following hinge quantities for each door leaf.

    a. For doors up to 87 inches high, provide three hinges per leaf.
    b. For doors more than 87 and up to 120 inches high, provide four hinges per leaf.

3. Nonremovable Pins: In exterior doors, provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
4. Weight: Unless otherwise specified, furnish the following hinge weight and type for each door leaf.

    a. Interior doors without door closers: provide standard weight ball bearing hinges.
    b. Interior doors with door closers: provide heavyweight ball bearing hinges.
    c. Exterior and vestibule doors: provide heavyweight ball bearing hinges fabricated from brass, bronze, or stainless steel.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Levers: Cast.

    a. Schlage/Allegion plc; Rhodes lever (Style 06/RHO).

2. Escutcheons (Roses): Cast.

    a. In restroom locations indicated in drawings, provide Schlage/Allegion plc; ND Series Status Indicator Escutcheon on exterior side of door.

3. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

F. Bored Locks: ANSI/BHMA A156.2, Operational Grade 1, Series 4000.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schlage (Allegion plc); ND Series or comparable product by one of the following:

a. BEST Access Solutions, Inc.; dormakaba USA Inc.
b. Hager Companies.
c. STANLEY; dormakaba USA, Inc.

G. Mortise Locks: ANSI/BHMA A156.13, Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schlage (Allegion plc); L Series or comparable product by one of the following:

a. BEST Access Solutions, Inc.; dormakaba USA Inc.
b. Hager Companies.
c. STANLEY; dormakaba USA, Inc.

2.5 ELECTRIC STRIKES

A. Electric Strikes: ANSI/BHMA A156.31, Grade 1; with faceplate to suit lock and frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Von Duprin (Allegion plc); 6100 Series or comparable product by one of the following:

a. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY.
b. Hager Companies.
c. STANLEY; dormakaba USA, Inc.

2.6 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: ANSI/BHMA A156.25, Grade 1; motor or solenoid driven; with strike that suits frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schlage (Allegion plc); AD Series or comparable product by one of the following:

a. BEST Access Solutions, Inc.; dormakaba USA Inc.
b. SARGENT Manufacturing Company; ASSA ABLOY.
c. STANLEY; dormakaba USA, Inc.

2. Type: Mortise latchbolt.

2.7 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: ANSI/BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Basis-of-Design Product: Subject to compliance with requirements, provide IVES (Allegion plc); FB Series or comparable product by one of the following:

a. Adams Rite Manufacturing Company, an ASSA ABLOY Group company.
b. Don-Jo Mfg., Inc.
c. INOX; Unison Hardware, Inc.

2.8 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Von Duprin (Allegion plc); 98/99 Series or comparable product by one of the following:

a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
b. Hager Companies.
c. STANLEY; dormakaba USA, Inc.

2.9 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Interchangeable.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.10 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System:

a. Master key or grand master key locks to Owner's existing system.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.11 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6.

1. Basis-of-Design Product: Subject to compliance with requirements, provide IVES (Allegion plc) or comparable products by one of the following:

a. Don-Jo Mfg., Inc.
b. Hager Companies.
c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2. Offset Door Pull: IVES 8190HD-0.

a. Size: 1-inch diameter with 10-inch center-to-center.
b. Offset: 4.5 inches.
c. Clearance: 2.25 inches between pull and door.

3. Pull Plate: IVES 8303.

a. Plate Size: 4 inches by 16 inches.
b. Pull Size: 1-inch diameter with 10-inch center-to-center.
c. Clearance: 1.5-inch clear between plate and pull.

4. Push Plate: IVES 8200.

a. Size: 4 inch by 16 inch.

2.12 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide LCN (Allegion plc); 4050A Series or comparable product by one of the following:

a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
b. Hager Companies.
c. STANLEY; dormakaba USA, Inc.

2.13 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide IVES (Allegion plc); WS406/407 Series or comparable product by one of the following:

    a. Don-Jo Mfg., Inc.
    b. Hager Companies.
    c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2. Application: Furnish a stop or holder for all doors.

    a. Furnish floor stops or hinge pin stops only where specifically specified.
    b. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.
    c. Where wall stops are not applicable, furnish overhead stops.
    d. Do not provide holder function for labeled doors.

B. Wall- and Floor-Mounted Holders: ANSI/BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide IVES (Allegion plc); WS40 or comparable product by one of the following:

    a. Don-Jo Mfg., Inc.
    b. Hager Companies.
    c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

C. Overhead Stops and Holders: ANSI/BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Glynn-Johnson (Allegion plc); 90 Series (10 Series for concealed applications) Series or comparable product by one of the following:

    a. Don-Jo Mfg., Inc.
    b. Hager Companies.
    c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2. Application: Unless otherwise specified, furnish for hollow metal or 1-3/4” solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4” solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

    a. Do not provide holder function for labeled doors.

2.14 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: ANSI/BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interfaced with fire-alarm system for labeled fire-rated door assemblies.

1. Basis-of-Design Product: Subject to compliance with requirements, provide FSH By Schlage (Allegion plc); 3500 Series or comparable product by one of the following:

a. dormakaba USA Inc.
b. Hager Companies.
c. SARGENT Manufacturing Company; ASSA ABLOY.

2.15 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of 0.3 inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. of door opening.

2.16 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zero International (Allegion plc); 63/8655 Saddle, 1674 Half-Saddle, 74A Interlocking, or comparable product by one of the following:

a. National Guard Products, Inc.
b. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
c. Reese Enterprises, Inc.

2.17 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Protective Plates: Provide protection plates as specified in the drawings.

a. Features: All protective plates to be beveled on all edges with mounting holes counter-sunk for flush-faced fasteners.
b. Width: All protective plates to be 2 inches less than door panel width, or 1 inch less than door width at pairs.
c. Mop Plate: 4 inches in height.

d. Kick Plate: 10 inches in height.
e. Armor Plate: 34 inches in height.
f. Rated Doors: Unless otherwise indicated, fire-rated doors shall not receive protection plates larger than 16 inches in height. Fire-rated doors requiring protection plates exceeding 16 inches in height shall be UL-certified to meet UL10C standards.
g. Adjustments: Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2. Surface-Mounted Door Edges: Where indicated in drawings, provide surface-mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required to accommodate adjacent hardware.

2.18 AUXILIARY DOOR HARDWARE

A. Auxiliary Door Hardware: ANSI/BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc and its corresponding subsidiaries, or comparable product.

2.19 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware, General: ANSI/BHMA A156.35.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc and its corresponding subsidiaries, or comparable product compatible with electrified door hardware and owner's existing door control system.

B. Power Transfers: Basis-of-Design Product: Provide Von Duprin (Allegion plc); EPT-2 for two wire applications or EPT-10 for ten wire applications.

C. Power Supplies:

1. Provide quantities and types as specified in hardware sets. Shared power supplies will not be accepted without prior approval from the owner.
2. All power supplies shall have the following features:

a. 12/24 VDC Output, field selectable.
b. Class 2 Rated power limited output.
c. Universal 120-240 VAC input.
d. Low voltage DC regulated and filtered.
e. Polarized connector for distribution boards.
f. Fused primary input.
g. AC input and DC output monitoring circuit w/LED indicators.
h. Cover mounted AC Input indication.
i. Tested and certified to meet UL294.
j. NEMA 1 enclosure.
k. Hinged cover w/lock down screws.

l. High voltage protective cover.
m. Fused distribution boards.

3. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.20 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Closers to doors and frames.
2) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 FINISHES

A. Unless otherwise indicated in the hardware schedule, provide finishes complying with ANSI/BHMA A156.18 as indicated below:

1. Butt Hinges, Exterior or Non-Ferrous: 630 (US32D - Satin Stainless Steel).
2. Butt Hinges, Interior: 652 (US26D - Satin Chromium).
3. Flush Bolts: 626 (US26D - Satin Chromium).
4. Exit Devices: 626 (US26D - Satin Chromium).
5. Locks and Latches: 626 (US26D - Satin Chromium).
6. Pulls and Push Plates/Bars: 630 (US32D - Satin Stainless Steel).
7. Closers: 689 (Powder Coat Aluminum).
8. Protective Plates: 630 (US32D - Satin Stainless Steel).
9. Overhead Stops: 630 (US32D - Satin Stainless Steel).
10. Wall Stops and Holders: 630 (US32D - Satin Stainless Steel).
11. Thresholds: 719 (Mill Aluminum).
12. Weather-strip, Sweeps, and Drip Caps: Aluminum Anodized.
13. Miscellaneous: 626 (US26D - Satin Chromium.

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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION OF DOOR HARDWARE

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

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

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant is to examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

END OF SECTION

SECTION 087113 - POWER DOOR OPERATORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low-energy door operators for swinging doors.

1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

D. For automatic door terminology, see BHMA A156.19 for definitions of terms.

1.3 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control power door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing power door operators.

C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

D. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to the following:

1. Power supplies.
2. Access-control system.
3. Remote activation devices.
4. Remote monitoring systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for power door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of power door operator.

C. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For power door operators, safety devices, and control systems, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of power door operator, including controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 POWER DOOR OPERATORS, GENERAL

A. Basis-of-Design Product: Subject to compliance with requirements, provide LCN (Allegion plc); 9500 Senior Swing Series or comparable product by one of the following:

1. dormakaba USA Inc.
2. Hager Companies.
3. SARGENT Manufacturing Company; ASSA ABLOY.

B. Source Limitations: Obtain power door operators, including activation and safety devices, from single source from single manufacturer.

C. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load indicated in drawings.

D. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

E. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- thick, extruded or formed aluminum; manufacturer's standard width; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

F. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

C. Configuration, Single: Operator to control single swinging door.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

D. Configuration, Wheelchair Lift: Operator to control swinging door and swinging gate on either side of lift system.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

E. Operation, Single: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

F. Operation, Wheelchair Lift: Power opening and spring closing. Tie into existing elevator call button and door interlock so that doors only operate when elevator lift is in correct position. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. .

G. Operating System: Electromechanical.

H. Microprocessor Control Unit: Solid-state controller.

I. Features:

1. Adjustable opening speed.
2. Adjustable opening force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable acceleration.
6. Obstruction recycle.
7. On-off/hold-open switch to control electric power to operator.

J. Activation Device: Push-plate switch on each side of door to activate door operator.

K. Exposed Finish: Finish matching door and frame.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221.
2. Sheet: ASTM B209.

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.4 CONTROLS

A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.

1. Configuration:

a. Round or Square Push Plate: 4-by-4-inch junction box.

1) Mounting: As indicated on Drawings.

2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
3. Message: International symbol of accessibility and "Push to Open."

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

D. Wheelchair Lift Systems: Tie into existing wheelchair lift system shown on Drawings. Coordinate with Owner's elevator maintenance service contract-holder for schematics to incorporate push-plate switch with elevator call and door interlock. Remove existing call button.

2.5 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Operator manufacturer's standard process.

2.6 FABRICATION

A. Factory fabricate power door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of power door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before power door operator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.

B. Controls: Install activation and safety devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each power door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Power door operators will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust power door operators to function smoothly and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for tight closure.

B. After completing installation of power door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: 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.

3.5 DEMONSTRATION

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

END OF SECTION

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SECTION 088000 - GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Preconstruction adhesion and compatibility test report.

D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
2. 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. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

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

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS 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. Cardinal Glass Industries, Inc.
2. Guardian Glass LLC.
3. Pilkington North America; NSG Group.
4. Vitro Architectural Glass.

B. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) as indicated, Quality-Q3.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide color PVB interlayers from Vanceva (Eastman Chemical Company) or comparable product by one of the following:

    a. Carvart.
    b. Dreamwalls by Gardner Glass Products.
    c. Kuraray America, Inc.

2. Construction: Laminate glass with polyvinyl butyral (PVB) interlayer to comply with interlayer manufacturer's written instructions.
3. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
4. Interlayer Color: As selected by Architect from manufacturer's full range.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer

rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

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

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry

surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.7 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type (GLZ-1): Annealed float glass.

1. Minimum Thickness: 6 mm.

B. Clear Glass Type (GLZ-2): Fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Provide safety glazing labeling.

3.8 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type (GLZ-3):

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Annealed float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Annealed float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. U-Factor: Refer to requirements of assembly U-Factor minimums.
8. SGHC: Refer to requirements of assembly SGHC maximums.

B. Low-E-Coated, Clear Tempered Glass Type (GLZ-4):

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. U-Factor: Refer to requirements of assembly U-Factor minimums.
8. SGHC: Refer to requirements of assembly SGHC maximums.
9. Provide safety glazing labeling.

3.9 INSULATING-LAMINATED-GLASS SCHEDULE

A. Color Interlayer, Insulating Laminated Glass Type (GLZ-5):

1. Overall Unit Thickness: 1-5/16 inch.

2. Outdoor Lite: Clear laminated glass with two plies of annealed float glass.

    a. Minimum Thickness of Each Glass Ply: 6 mm.
    b. Interlayer Thickness: 0.090 inch.

3. Interspace Content: Argon.
4. Minimum Thickness of Indoor Lite: 6 mm.
5. Indoor Lite: Annealed float glass.
6. Low-E Coating: Pyrolytic or sputtered on fourth surface.
7. U-Factor: Refer to requirements of assembly U-Factor minimums.
8. SGHC: Refer to requirements of assembly SGHC maximums.

B. Color Interlayer, Insulating Laminated Tempered Glass Type (GLZ-6):

1. Overall Unit Thickness: 1-5/16 inch.
2. Outdoor Lite: Clear laminated glass with two plies of fully tempered float glass.

    a. Interlayer Thickness: 0.090 inch.

3. Interlayer Color: Blue.
4. Interspace Content: Argon.
5. Minimum Thickness of Indoor Lite: 6 mm.
6. Indoor Lite: Clear fully tempered float glass.
7. Sealant: Install using sealant specified in Section 088853 "Security Glazing."
8. Low-E Coating: Pyrolytic or sputtered fourth surface.
9. U-Factor: Refer to requirements of assembly U-Factor minimums.
10. SGHC: Refer to requirements of assembly SGHC maximums.
11. Provide safety glazing labeling.

END OF SECTION

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SECTION 088853 - SECURITY GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Laminated-glass security glazing.

1.2 DEFINITIONS

A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports:

a. For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency.
b. For each type of glazing sealant, for tests performed by a qualified testing agency.

1) Provide test reports based on testing current sealant formulations within previous 36-month period.

2. Preconstruction Test Reports: For preconstruction adhesion and compatibility testing.

B. Qualification Statements: For installers, glazing testing agency, and sealant testing agency.

C. Sample warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.
2. Security Glazing Testing Agency: Subject to compliance with requirements, testing agency is one of the following:

    a. Intertek.
    b. Underwriters Laboratories, Inc.
    c. Wiss, Janney, Elstner Associates, Inc.

3. Sealant Testing Agency: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Special Warranty, Laminated-Glass Security Glazing: Manufacturer agrees to replace laminated-glass security glazing that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated-glass security glazing 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.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of security glazing from single source from single manufacturer.

B. Obtain glazing sealants and gaskets from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. Installed security glazing will withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
2. Installed security glazing will withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

C. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements

are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. AAMA Publications: AAMA GDSG-1 and AAMA TIR-A7.
2. NGA Publications: "Laminated Glazing Reference Manual" and"GANA Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council or the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label will indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition as required to meet performance requirements.

C. Chemically Strengthened Glass: Annealed float glass is chemically strengthened to comply with ASTM C1422/C1422M, Surface Compression Level and Case Depth as required to meet performance requirements.

2.5 LAMINATED-GLASS SECURITY GLAZING

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Guardian Glass; Guardian Industry Holdings.
2. McGrory Glass, Inc.
3. OldCastle BuildingEnvelope (OBE).

B. Laminated-Glass Security Glazing: ASTM C1172. Two or more glass lites bonded with interlayer. 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 Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
2. Interlayer Color: Clear unless otherwise indicated.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, 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 security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of Industry colors.

B. Glazing Sealant:

1. Neutral-Curing Silicone Structural Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT, G, and A.

a. Basis-of-Design Product: Subject to compliance with requirements, provide The Dow Chemical Company; DOWSIL 995 or comparable product approved by glazing manufacturer.
b. Applications: Along the inside face (safe side) of frames receiving Laminated-Glass and -Polycarbonate Security Glazing.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C1281 and AAMA 807.3.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Type recommended in writing by sealant or security glazing manufacturer.

E. Edge Blocks:

1. Type recommended in writing by sealant or security glazing manufacturer.

2.9 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing 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. Grind smooth and polish exposed security glazing edges and corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing for security glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Minimum required bite.
5. Effective sealing between joints of framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

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

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of it off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness of slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and in accordance with requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center security glazing 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.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers, or spacers and backings, in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine security glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

C. Wash security glazing on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

3.7 LAMINATED-GLASS SECURITY GLAZING SCHEDULE

A. Attack-Resistant Security Glazing (GLZ-7): Clear laminated glass.

1. Basis-of-Design Product: McGrory Glass; DefendED.
2. Forced-Entry Resistance, ASTM F1233: Class 1.4 in accordance with ASTM F1233.
3. Nominal Overall Unit Thickness: 0.375-inch.
4. Overall Visible Light Transmittance: 0.82.
5. Provide safety glazing labeling.

3.8 INSULATING LAMINATED-GLASS SECURITY GLAZING SCHEDULE

A. Low-E-Coated Security Glazing (GLZ-8): Clear laminated glass.

1. Overall Unit Thickness: 1 inch.
2. Outdoor Lite: Clear laminated glass.
3. Interspace Content: Argon.
4. Indoor Lite: Fully tempered float glass.
5. Low-E Coating: Pyrolytic or sputtered on second or third surface.
6. U-Factor: Refer to requirements of assembly U-Factor minimums.
7. SGHC: Refer to requirements of assembly SGHC maximums.
8. Provide safety glazing labeling.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing systems.
2. Suspension systems.
3. Grid suspension systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Framing systems.
2. Suspension systems.
3. Grid suspension systems.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

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, in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft.

D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

E. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated.
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

    a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

C. Studs and Track: AISI S220.

1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
2. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: Top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Track System: Top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

E. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 as appropriate for the substrate.

   a. Uses: Securing hangers to structure.
   b. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
   c. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Furring Channels (Furring Members):

1. Steel Studs and Tracks: Depth indicated on Drawings.

2.4 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF FRAMING SYSTEMS

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

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 24 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch 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.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

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

3.5 INSTALLATION OF SUSPENSION SYSTEMS

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

1. Hangers: 48 inches o.c.
2. Furring Channels (Furring Members): 24 inches o.c.

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

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension

system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

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

3.6 INSTALLATION OF GRID SUSPENSION SYSTEMS

A. 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.

3.7 FIELD QUALITY CONTROL

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

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Texture finishes.
3. Interior trim.
4. Acoustical products and treatments.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 078413 "Penetration Firestopping" for sealants in fire-rated assemblies.
3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Acoustically enhanced gypsum board.
3. Mold-resistant gypsum board.
4. Interior trim.
5. Joint treatment materials.
6. Acoustical joint sealants.
7. Acoustical putties.
8. Textured finishes.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.3 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.

B. Standard: ASTM C1396.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed; SAINT-GOBAIN.
3. Georgia-Pacific Gypsum LLC.
4. Gold Bond Building Products, LLC provided by National Gypsum Company.
5. PABCO Gypsum.
6. Panel Rey.
7. USG Corporation.
8. Or Architect approved equal.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X:

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Saint-Gobain; CertainTeed Type X Gypsum Board or comparable product by one of the approved manufacturers.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.

B. Acoustically Enhanced Gypsum Board, Type X: ASTM C1766.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Saint-Gobain; CertainTeed SilentFX QuickCut Type X Acoustical Gypsum Board or comparable product by one of the approved manufacturers.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.

C. Mold-Resistant Gypsum Board, Type X: ASTM D3273.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Saint-Gobain; CertainTeed M2Tech Mold and Moisture Resistant Type X or comparable product by one of the approved manufacturers.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: Score of 10 as rated in accordance with ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
e. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, 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 tape 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.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.
2. Mold-Resistant Joint Compound: ProForm XP or Architect approved equal.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Acoustic Laminating Adhesive: Adhesive products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.

1. Adhesives shall have a VOC content of 250 g/L or less.

D. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

1. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

E. Acoustic Putties: Non-hardening dielectric, water-resistant, intumescent putties containing no solvents, inorganic fibers, or silicone compounds.

F. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

2.8 INSULATION

A. Thermal Insulation: As specified in Section 072100 "Thermal Insulation" for exterior walls and walls between conditioned and semi-conditioned spaces.

B. Sound-Attenuation Blankets:

1. Glass-Fiber Acoustic Blanket Insulation, Unfaced: ASTM C665, Type I.
2. Combustion Characteristics: Passes ASTM E136.
3. Fire Resistance Ratings: Part of ASTM E119 fire tested wall assemblies.
4. Sound Transmission Class: ASTM C423, STC based on manufacturer's published data on thickness and wall assembly. Refer to minimum STC requirements indicated on Drawings.

2.9 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.

1. Texture: Orange peel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered

edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. 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- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- 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. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF ACOUSTICAL JOINT AND PENETRATION SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

1. Outlet and switch boxes to be sealed on one side of assembly with intumescent putty to seal all air gaps between box and gypsum as well as between box and wires. Fire-rated assemblies, refer to Section 078413 "Penetration Firestopping."

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.
2. Ceiling Type: As indicated on Drawings.
3. Mold-Resistant Type: Restrooms and other wet areas as indicated on Drawings.
4. Acoustically-Enhanced Type: Between classrooms and walls surrounding music rooms as indicated on Drawings to require STC rating.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-shaped 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 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-shaped 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.
5. On high-STC-rated assemblies between classrooms and around music rooms, laminate multiple layers of gypsum together with acoustic-rated sealant where required to meet STC minimums listed on Drawings.

3.5 FINISHING OF 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 in accordance with ASTM C840:

1. Level 1: Ceiling plenum and concealed areas.
2. Level 5: Areas to receive wall coverings and other textured surfaces.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 APPLICATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093013 - CERAMIC TILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Setting material.
4. Grout materials.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of movement joints in tile surfaces.
2. Section 092900 "Gypsum Board" for tile backing panels.

1.2 DEFINITIONS

A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Large Format Tile: Tile with at least one edge 15 inches or longer.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For grout, and accessories involving color selection or shade variation.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Metal flooring transitions 4-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.

1. Warranty Period: Five years from date of Product Purchase.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Tile: Obtain tile from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.

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. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC.

2. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
3. Obtain underlayment from manufacturer of setting and grouting materials.
4. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
5. Obtain joint sealants from manufacturer of setting and grouting materials.

C. Accessory Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Backer units.

2.2 PRODUCTS, GENERAL

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

1. Provide tile complying with Standard Grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by

TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

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 installation indicated and has a record of successful in-service performance.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 PORCELAIN TILE

A. Porcelain Tile Type (TL-1, TL-3): Color Body Porcelain - Digital Inkjet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Alfalux Pietre Pure or comparable product by one of the following:

a. Iris Ceramics U.S., a division of Stonepeak Ceramics, Inc.
b. Portobello America, Inc.

2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12 by 24 inches.
4. Face Size Variation: Rectified.
5. Thickness: 3/8 inch.
6. Product Use Classification: Interior, Dry (ID),Interior, Wet (IW).
7. Tile Color, Glaze, and Pattern: As indicated by Architectural in drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.

B. Porcelain Tile Type (TL-2): Mosaic Color Body Porcelain - Digital Inkjet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Alfalux Pietre Pure or comparable product by one of the following:

a. Iris Ceramics U.S., a division of Stonepeak Ceramics, Inc.
b. Portobello America, Inc.

2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 2 by 2 inches on mesh mounted sheet.
4. Face Size Variation: Rectified.
5. Thickness: 3/8 inch.
6. Product Use Classification: Interior, Dry (ID),Interior, Wet (IW).
7. Tile Color, Glaze, and Pattern: As indicated by Architectural in drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.

C. Porcelain Tile Type (TL-4): Color Body Porcelain, Polished - Digital Inkjet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Alfalux Pietre Pure or comparable product by one of the following:

    a. Iris Ceramics U.S., a division of Stonepeak Ceramics, Inc.
    b. Portobello America, Inc.

2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 24 by 48 inches.
4. Face Size Variation: Rectified.
5. Thickness: 3/8 inch.
6. Tile Color, Glaze, and Pattern: As indicated by Architectural in drawings.
7. Grout Color: As selected by Architect from manufacturer's full range.

D. Porcelain Tile Type (TL-5): Glazed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ceramic Tileworks Minnesota, Tribeca or comparable product by one of the following:

    a. Equipe.
    b. Daltile.
    c. American Olean.

2. Face Size: 3 by 10 inches.
3. Thickness: 1/4 inch.
4. Tile Color, Glaze, and Pattern: As indicated by Architectural drawings.
5. Grout Color: As selected by Architect from manufacturer's full range.

E. Porcelain Tile Type (TL-6): Glazed Mosaic.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ceramic Tileworks Minnesota, Builder Basic Mosaics or comparable product by one of the following:

    a. American Olean; a brand of Dal-Tile Corporation.
    b. Daltile; a brand of Dal-Tile Corporation.

2. Module Size: Penny Round Sheet.
3. Thickness: 1/4 inch.
4. Face: Plain with cushion edges.
5. Surface: Smooth, without abrasive admixture.
6. Tile Color and Pattern: As indicated by Architectural drawings.
7. Grout Color: As selected by Architect from manufacturer's full range.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges in maximum lengths available to minimize end-to-end butt joints.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed; SAINT-GOBAIN.
b. James Hardie Building Products, Inc.
c. USG Corporation.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Waterproof Membrane, Fluid Applied: Liquid-latex rubber, elastomeric polymer, or elastomeric cementitious system.

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. Bostik; Arkema.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. TEC.

2.6 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Crack Isolation Membrane, Fluid Applied: Liquid-latex rubber, elastomeric polymer, or elastomeric cementitious system.

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. Bostik; Arkema.
b. Laticrete International, Inc.

c. MAPEI Corporation.
d. TEC.

2.7 SETTING MATERIALS

A. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik; Arkema.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. TEC.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.

2.8 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik; Arkema.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. TEC.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

B. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

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. Profilitec Corp.
b. Progress Profiles America Inc.
c. Schluter Systems L.P.

2. Description: Profiles as required by transition type as indicated in Architectural drawings.

3. Material and Finish: Metallic or combination of metal and PVC or neoprene base; exposed-edge material.

    a. Color: To be selected by Architect from manufacturers standard range.

C. Metal Edge Trim (SCHL-1): Profile designed for wall terminations and edge protection.

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. Profilitec Corp.
    b. Progress Profiles America Inc.
    c. Schluter Systems L.P.

2. Description: As indicated by transition type in Architectural drawings.
3. Terminations: End caps, Inside corners, Outside corners matching edge-protection profile.
4. Material and Finish: Aluminum or Stainless Steel.

    a. Finish/Color: To be selected by Architect from Manufacturers standard range.

D. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

E. 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.

F. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

D. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
2. 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.

E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.

2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. 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.
4. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

    a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
    b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

5. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, as required per TCNA standards. Coordinate locations on site with Architect. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

G. Metal Flooring Transitions: Install at locations indicated.

H. Metal Wall Trim: Install at locations indicated on Drawings.

I. Grout Sealer: Apply grout sealer to grout joints in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 FIELD QUALITY CONTROL

A. Water Test:

1. Test of waterproofing membrane in showers and similar areas to be performed by Installation Contractor before setting tile.

a. Perform test after 24 hours of waterproof membrane installation.
b. Insert test plug in drain or waste line.
c. Fill shower base with water, high enough that the membrane-to-drain connection and floor-to-wall transition can be evaluated, and mark wall.
d. Check for leaks after 24 hours.

B. Nonconforming Work:

1. Waterproof membrane will be considered defective if water level has dropped.
2. Remove and replace defective components and retest.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other

surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F111: Method ANSI A108.1C. Cement mortar bed (thickset) installed over cleavage membrane.

    a. Bond Coat for Cured-Bed Method: Modified dry-set mortar.
    b. Grout: High-performance sanded cement, High-performance unsanded cement grout.
    c. Joint Width: As recommended by tile manufacturer.

2. TCNA F125-Full: Thinset mortar on crack isolation membrane.

    a. Thinset Mortar: Improved Modified dry-set mortar.
    b. Grout: High-performance sanded cement grout.
    c. Crack Isolation Membrane: Fluid-applied membrane.
    d. Joint Width: As recommended by tile manufacturer.

B. Interior Wall Installations, Masonry or Concrete:

1. TCNA W202I: Thinset mortar over waterproof membrane.

    a. Thinset Mortar: Improved modified dry-set mortar.
    b. Grout: High-performance sanded or unsanded cement grout as appropriate for tile type.
    c. Waterproof Membrane: As recommended by setting material manufacturer.
    d. Joint Width: As recommended by tile manufacturer in accordance with TCNA.
    e. Movement Joints: Types located on Drawings.

2. TCNA W211: Method ANSI A108.1C. Cement mortar bed (thickset) bonded to substrate over waterproof membrane.

    a. Bond Coat for Cured-Bed Method: Improved Modified dry-set mortar.
    b. Grout: Standard unsanded cement grout.
    c. Waterproof Membrane: As recommended by setting material manufacturer.

d. Joint Width: As recommended by tile manufacturer in accordance with TCNA standards.
e. Movement Joints: Types located on Drawings.

END OF SECTION

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SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch long Sample of each type.
3. Exposed Moldings and Trim: Set of 6-inch long Samples of each type and color.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.

e. Sprinklers.
f. Access panels.
g. Perimeter moldings.
h. Cameras.

7. Show operation of hinged and sliding components adjacent to acoustical tiles.
8. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Product Test Reports: For each acoustical tile ceiling, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra material, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical 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.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and grids with ceiling penetrations including but not limited to light fixtures, HVAC equipment, fire-suppression, and partition assemblies as shown in Drawings.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Suspended Acoustical Tile Ceiling System: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

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

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL TILES

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Acoustical Tiles (ACT-1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; ULTIMA or comparable product as approved by the Architect.
2. Classification: Provide tiles as follows:

    a. Type and Form, Type III: Mineral fiber base with painted finish.
    b. Surface Pattern: Fine textured.

3. Color: White.
4. Light Reflectance (LR): Not less than 0.88.
5. Ceiling Attenuation Class (CAC): Not less than 35.
6. Noise Reduction Coefficient (NRC): Not less than 0.75.
7. Articulation Class (AC): Not less than 170.
8. Edge/Joint Detail: Beveled tegular.
9. Thickness: 3/4 inch.
10. Modular Size: 24 by 24 inches.

C. Acoustical Tiles (ACT-2):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; GEORGIAN or comparable product as approved by the Architect.
2. Classification: Provide tiles as follows:

a. Type and Form, Type III, Form 2: Mineral fiber base with painted finish.
b. Surface Pattern: Medium textured.

3. Color: White.
4. Light Reflectance (LR): Not less than 0.88.
5. Edge/Joint Detail: Beveled tegular.
6. Thickness: 5/8 inch.
7. Modular Size: 24 by 24 inches.
8. High Washability Treatment: Meets USDA/FSIS guidelines for use in food processing establishments.
9. Anti Mold/Mildew Treatment: BioBlock performance resisting growth of mold and mildew.

2.4 METAL SUSPENSION SYSTEM

A. Concealed or Semi-Exposed Metal Suspension System:

1. Manufacturers: Provide from the same manufacturer as the acoustical panels.
2. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C635/C635M.

a. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" in accordance with ASTM C635/C635M.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection, Carbon Steel: Components zinc plated in accordance with ASTM B633, Class SC 1 (mild) service condition.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 12-gauge wire.

C. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Metal Edge Moldings and Trim:

1. Manufacturers: Provide from the same manufacturer as the acoustical panels.
2. 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 of suspension-system runners.

a. Edge moldings to fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
c. Finish: Painted white.

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. 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 unless otherwise indicated and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. 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. 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.
3. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. 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.
5. anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

C. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

D. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
3. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 INSTALLATION OF DIRECTLY ATTACHED ACOUSTICAL TILE CEILINGS

A. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

3.5 ERECTION TOLERANCES

A. Install suspended ceiling systems, moldings, and trim level to a tolerance of 1/4 inch in 10 feet, non-cumulative in accordance with ASTM C636/C636M.

3.6 ADJUSTING

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.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 096466 - WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood athletic flooring materials.
2. Subfloor materials.

B. Related Requirements:

1. Section 099300 “Staining and Transparent Finishing” for stains, sealers, finish systems and game line and marker paint for athletic flooring.

1.2 COORDINATION

A. Coordinate layout and installation of slab depressions to accommodate layout and height of wood athletic flooring assembly.

1. Slab drepession is 1-3/4 inch for 25/32-inch flooring.
2. The contractor shall furnish and install the concrete subfloor depressing the slab sufficiently to accommodate the floor system. The slab shall be steel troweled smooth to a tolerance of 1/8” (3mm) in any 10’ (3m) radius by the general contractor. High spots shall be ground level, and low spots filled in with approved leveling compound by the general contractor to the full approval of the flooring contractor.
3. The concrete substrate shall be deemed fully cured by industry standards through field testing moisture content of concrete using embedded Relative Humidity testing probes. Concrete RH of 85% or less shall be achieved prior to installing subfloor components when including a standard 6-mil (0.15mm) vapor retarder.

B. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood athletic flooring.

B. Shop Drawings: For each type of floor assembly, include the following:

1. Plans, sections, and attachment details.
2. Details of concrete-slab depressions.
3. Locations of different grades of wood flooring.
4. Expansion provisions and trim details.
5. Layout, colors, widths, and dimensions of game lines and markers.
6. Locations of floor inserts for athletic equipment installed through flooring assembly.

C. Samples for Initial Selection: For each type of wood athletic flooring and accessory in each type of exposed color and finish.

1. Include manufacturer's color charts showing colors and glosses available for the following:

a. Floor finishes.
b. Game-line and marker paints.

D. Samples for Verification: For each type of wood athletic flooring and accessory required; approximately 12 inches long and of same thickness and material indicated for the Work.

1. Include Sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include Sample sets showing finishes and game-line and marker paints applied to wood flooring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wood athletic flooring and finish systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual that has been approved by MFMA as an accredited Installer according to the MFMA Accreditation Program.

1. Installer responsibilities include installation and field finishing of wood athletic flooring components and accessories, and application of game lines and markers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver floor assembly materials in unopened cartons or bundles.

B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.

C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.7 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before wood athletic flooring installation, is continuous through installation, and continues not less than seven days after installation.

1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants, but not less than 35 percent or

more than 50 percent, in spaces to receive wood athletic flooring during the conditioning period.

2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.

    a. Do not install wood athletic flooring until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
    b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install wood athletic flooring after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 WOOD ATHLETIC FLOORING SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Aacer Sports Flooring (an Infinity Wood Floors Company); PowerPlay Panel or comparable product by one of the following:

1. Action Floor Systems, LLC.
2. Horner Sports Flooring.
3. WD Flooring, LLC.

B. System Type: Steel Channel Anchored.

C. Overall System Height: 1-3/4 inches.

2.2 FLOORING MATERIALS

A. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.

1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

B. Random-Length Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.

1. Grade: MFMA-RL First.

    a. Exception: For areas under stacked portion of telescoping bleachers that are normally concealed from view, provide Third and Better Grade.

2. Cut: Flat.
3. Thickness: 25/32 inch.
4. Face Width: 2-1/4 inches.

2.3 SUBFLOOR MATERIALS

A. Plywood Underlayment: APA rated, C-D plugged, exterior glue, tongue and groove, 23/32 inch thick.

1. With machined anchor pockets, and resilient lineal Aacer Cushions pre-attached.

B. Channels: Manufacturer's standard as indicated by product designation above.

1. Channel Anchors: Manufacturer's standard, but not less than modified steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf pullout strength.

C. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.

1. Type: Manufacturers Standard - Recessed Panel Cushion.
2. Material: Polyurethane Foam.
3. Thickness: 3/4 inch.

2.4 FINISHES

A. Floor-Finish System: As specified in Section 099300 “Staining and Transparent Finishing.”.

2.5 ACCESSORIES

A. Vapor Retarder: ASTM D4397, polyethylene sheet not less than 6 mils thick.

B. Resilient Wall Base: As specified in Section 096513 “Resilient Base And Accessories.”.

C. Thresholds: As specified in Section 087100 “Door Hardware.”.

D. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood athletic flooring manufacturer.

F. Adhesives: Manufacturer's standard for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.
b. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Concrete Slabs:

1. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
3. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.

B. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with wood athletic flooring manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.

B. Pattern: Lay flooring parallel with long dimension of space to be floored unless otherwise indicated.

C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.

1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.

D. Vapor Retarder: Cover entire slab area beneath wood flooring. Install with joints lapped a minimum of 6 inches and sealed.

E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.

F. Channels: Anchor channels to substrate according to manufacturer's written instructions.

1. Install wood strip flooring across channels.
2. Insert steel clip at each intersection of a flooring strip with a channel.

G. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 SANDING AND FINISHING

A. Allow installed flooring to acclimate to ambient conditions before sanding.

B. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide no fewer than four coats total and no fewer than two finish coats.

1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.

a. Basis of Design product; Hillyard, Diamond 1K Gym Finish.

2. Apply stain color(s) - as indicated on drawings - prior to floor finish and game-lines.
3. Game-Line and Marker Paint: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.

a. Mask flooring at game lines and markers and apply paint to produce lines and markers with sharp edges.
b. Where game lines cross, break minor game line at intersection; do not overlap lines.
c. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
d. Apply finish coats after game-line and marker paint is fully cured.

3.5 PROTECTION

A. Protect wood athletic flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

1. Do not cover flooring after finishing until finish reaches full cure and not before seven days after applying last finish coat.
2. Do not move heavy and sharp objects directly over flooring. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic-rubber base.
2. Vinyl molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. 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 long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

A. Rubber Wall Base (RWB-1): ASTM F1861, Type TP, Group I.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mannington Commercial; Burkebase or comparable product approved by the Architect.
2. Style and Location:

    a. Style B, Cove: Provide in all areas designated.

3. Thickness: 1/8 inch.
4. Height: 4 inches.
5. Lengths: Coils in manufacturer's standard length.
6. Outside Corners: Job formed.
7. Inside Corners: Job formed.
8. Colors: As indicated on drawings.

B. Rubber Wall Base (RWB-2): ASTM F1861, Type TP, Group I.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite (A Tarkett Company); Millwork Exhibit or comparable product approved by the Architect.
2. Style and Location:

    a. Style D, Sculpted: Provide in all areas designated.

3. Thickness: 1/4 inch.
4. Height: 8 inches.
5. Lengths: Coils in manufacturer's standard length.
6. Outside Corners: Job formed.
7. Inside Corners: Job formed.
8. Colors: As indicated on drawings.

C. Rubber Wall Base (RWB-3): ASTM F1861, Type TS, Group I.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite (A Tarkett Company); Baseworks or comparable product approved by the Architect.
2. Style and Location:

    a. Style B, Cove: Provide in all areas designated.

3. Thickness: 1/8 inch.
4. Height: 4 inches.
5. Lengths: Coils in manufacturer's standard length.
6. Outside Corners: Job formed.

7. Inside Corners: Job formed.
8. Colors: As indicated on drawings.

2.2 VINYL MOLDING ACCESSORIES

A. Basis-of-Design Product: Johnsonite Wheeled Traffic Transition, or comparable product subject to compliance with requirements.

1. Description: Rubber carpet edge for glue-down applications.
2. Profile and Dimensions: As indicated on drawings. Field verify height transition.
3. Locations: Provide rubber molding accessories in areas indicated on drawings.
4. Colors and Patterns: Architect to select from manufacturer’s full range.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

    a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. 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 Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Unbacked rubber sheet flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of type required.

D. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet 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 or more than 90 deg F. Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 UNBACKED RUBBER SHEET FLOORING (SV-1)

A. Safety Flooring (SV-1): EN13845. Heavy-duty safety flooring with enhanced slip-resistance.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Polyflor; Polysafe Ultima or comparable product by one of the following:

    a. Flexco Corporation.
    b. Johnsonite; A Tarkett company.
    c. VPI Corporation.

2. Gauge: 2.5 mm.
3. Residual Indentation: Less than 0.005 inches with 750 psi in accordance with ASTM F970.
4. Sheet Width: 2m.
5. Seamless-Installation Method: Heat welded.
6. Colors and Patterns: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

    a. Colors: Match flooring.

D. Integral-Flash-Cove-Base Accessories:

1. Flash Cove Former: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring 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 resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to 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.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury Vinyl Floor Tile.
2. Resilient Quartz Tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 LUXURY VINYL FLOOR TILE (LVT-1)

A. Approved Manufacturer:

1. Shaw Industries.

B. Tile Standard: ASTM F1700, Class III, Type B.

C. Thickness: 5 mm.

D. Wear Layer: 20 mil.

E. Size: 9 by 48 inches.

F. Finish: ExoGuard+

G. Colors and Patterns: Match Architect's samples.

H. Installation Type: Loose lay, direct glue.

2.2 RESILIENT QUARTZ FLOOR TILE (QT-1, QT-2, QT-3)

A. Approved Manufacturer:

1. Kahrs Upofloor.

B. Thickness: 2mm.

C. Size: 24 by 24 inches.

D. Surface: Type A, smooth.

E. Static Load: Maximum 0.002 inches @ 3,500 psi.

F. Colors and Patterns: Match Architect's samples.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of 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 ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by 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: Perform tests so that each test area does not exceed 200 sq. ft.,and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. 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 on drawings.

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.

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. Adhere floor tiles to 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.

H. Following installation of Resilient Quartz Tile (typically within an hour after installing) roll entire floor area twice in two perpendicular directions with minimum 100-ound roller to ensure proper bonding.

3.4 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 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.

1. Light foot traffic is permitted after 12 hours following installation.
2. Avoid heavy traffic, equipment rolling for up to 48 hours after installation.

D. Cover floor tile until Substantial Completion at all times.

END OF SECTION

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SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubber sheet flooring.
2. Adhesives.

B. Related Requirements:

1. Section 03300 - Cast-In-Place Concrete Floor substrate requirements.
2. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details and locations of the following:

1. Seam locations for sheet flooring.

C. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch-square in size and of same thickness and material indicated for the Work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sheet Flooring: Furnish full-width rolls of not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of flooring installed.

1.5 QUALITY ASSURANCE

A. Sheet Vinyl Flooring Installer Qualifications: An experienced installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration.

1. Store rolls upright.
2. Acclimation: Rolled goods must be unrolled and allowed to relax and acclimate for 24 hours prior to installation.

1.7 FIELD CONDITIONS

A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After post-installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

1.8 WARRANTY

A. Manufacturer’s Commercial Warranty: Fitness & Rec shall be warranted for 10 years for material or manufacturer defects.

PART 2 PRODUCTS

2.1 RUBBER SHEET FLOORING (RBR-1)

A. Acceptable Manufacturer: provide products by the following.

1. Capri Collections.

B. Description: Rubber athletic flooring provided as rolled goods for adhered installation.

C. Material: ASTM F3041 Bonded Crumb Rubber.

D. Static Load: ASTM F970, Passes 250 lbs.

E. Abrasion Resistance: ASTM D3389, Passes less than 1g loss.

F. Hardness: ASTM D2240, 60 Shore A.

G. Slip Resistance: Greater than 0.9 wet/dry.

H. Roll Size: 4 feet wide by 25 feet long.

I. Thickness: 8 mm.

J. Color and Pattern: Indicated on Drawings.

2.2 RUBBER SHEET FLOORING (RBR-2)

A. Acceptable Manufacturer: provide products by the following.

1. American Biltrite.

B. Description: ABPURE Imagine Nfuse is a collection of homogeneous rubber sheet flooring. It is PVC Free, phthalates free and has obtained the Declare Red List Free certification. It features the patented Nfuse technology for pure colors that last, as well as not requiring any waxing for the lifetime of the flooring.

C. Material: ASTM F1859 Type 1 rubber.

D. Static Load: ASTM F970, Passes up to 2,000 psi.

E. Roll Size: 5 feet wide by 50 feet long.

F. Thickness: 3 mm.

G. Color and Pattern: Indicated on Drawings.

2.3 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Type recommended in writing by manufacturer for substrate and conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.

1. Do not install flooring until it is the same temperature as space where it is to be installed.

F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

E. Traffic Limits: No traffic, leaning, finishing, or placement of furniture or equipment should occur in accordance with adhesive traffic limits and technical data.

3.4 SHEET FLOORING INSTALLATION

A. Unroll sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Locate seams according to approved Shop Drawings.

C. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

D. Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.

3.5 MAINTENANCE

A. Daily Maintenance: Long-term care and maintenance must be performed in accordance with daily and routine maintenance instructions published in manufacturers care & maintenance documents.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
2. Sweep and vacuum flooring thoroughly.
3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION

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SECTION 096723 - RESINOUS FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resinous flooring.
2. Integral cove base accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each resinous flooring component.

C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 RESINOUS FLOORING

A. Resinous Flooring System (CONC-2): Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

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. Sherwin-Williams High Performance Flooring.
    b. Sika Corporation; Flooring.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

C. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range.
2. Wearing Surface: Textured for slip resistance.
3. Overall System Thickness: 40 mils (1.0 mm).

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:

1. Compressive Strength: 7,500 psi minimum in accordance with ASTM C579.
2. Tensile Strength: 4,500 psi minimum in accordance with ASTM C307.
3. Water Absorption: 0.2 percent maximum in accordance with ASTM C413.
4. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation in accordance with MIL-D-3134J.
5. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) in accordance with MIL-D-3134J.
6. Abrasion Resistance: 60 mg maximum weight loss in accordance with ASTM D4060.
7. Hardness: 80, Shore D in accordance with ASTM D2240.

E. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.

F. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.

G. Body Coats:

1. Resin: Epoxy.
2. Formulation Description: High solids.
3. Type: Pigmented.
4. Installation Method: Self-leveling slurry with broadcast aggregates.
5. Number of Coats: Two.
6. Thickness of Coats: 10 mils.
7. Aggregates: Vinyl flakes.

H. Topcoats: Sealing or finish coats.

1. Resin: Urethane.
2. Formulation Description: High solids.
3. Type: Clear.
4. Number of Coats: One.
5. Thickness of Coats: 3 mils.
6. Finish: Matte.

2.3 INTEGRAL COVE BASE ACCESSORIES

A. Precast, Integral Cove Base: Impact-resistant, polymer-resin, cove base moldings with a grit profile to promote adhesion of resinous flooring and recommended in writing by resinous flooring manufacturer.

1. 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. SpeedCove, Inc.

2. Radius Cove: Cove molding with approximately 1-inch (25-mm) radius for adhesive installation at floor-to-wall joint as substrate to receive resinous flooring system to form an integral cove base.
3. Radius Cove Base: 6-inch- (152-mm-) high base molding that provides approximately 1-inch (25-mm) radius cove at floor-to-wall joint; for adhesive installation as substrate for resinous flooring system to form an integral cove base.

    a. Preformed Inside and Outside Corners: Provide manufacturer's standard square inside and 3/4- to 1-inch (19- to 25-mm) bullnose outside corners.

B. Installation Adhesive: As recommended in writing by accessory manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

    a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.

1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

C. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.

D. Optional Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 6 inches high.

E. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.

1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.

F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.

G. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.

3.5 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile.
2. Adhesives.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern type, location, and direction.
6. Type, color, and location of insets and borders.
7. Type, color, and location of edge, transition, and other accessory strips.
8. Transition details to other flooring materials.

C. Samples for Verification: Actual sample of finished products 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: 6-inch- long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Sample Warranties: For carpet tile.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. 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.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 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 levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

1.9 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 requirements.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.

b. Loss of tuft-bind strength.
c. Excess static discharge.
d. Delamination.
e. Dimensional instability.
f. Edge ravel.
g. Colorfastness to light & atmospheric contaminants.

3. Warranty Period: Lifetime Commercial Limited from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CARPET TILE (CPT-1)

A. Manufacturers: Subject to compliance with requirements, provide products by the following.

1. Shaw Industries Group, Inc.; Berkshire Hathaway Company.

B. Style: Disperse Color Ecoworx Tile.

C. Color: Match Architect's samples.

D. Pattern: Match Architect's samples.

E. Fiber Content: Ecosolution Q100 Nylon.

F. Pile Characteristic: Multi-level pattern loop.

G. Density: 6128 oz./cu. yd.

H. Thickness: 0.226 inches for finished carpet tile in accordance with ASTM D6859.

I. Stitches: 8.5 per inch.

J. Gage: 1/12 inch.

K. Tufted Weight: 16 oz./sq. yd. for finished carpet tile.

L. Primary Backing/Backcoating: Manufacturer's standard synthetic.

M. Secondary Backing: Ecoworx Tile.

N. Size: 24 by 24 inches.

O. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

P. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Delamination: Not less than 3.5 lbf/in. > in accordance with ASTM D3936.
3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.

2.2 CARPET TILE (CPT-2)

A. Manufacturers: Subject to compliance with requirements, provide products by the following.

1. Shaw Industries Group, Inc.; Berkshire Hathaway Company.

B. Style: Habitat Tile.

C. Color: Match Architect's samples.

D. Pattern: Match Architect's samples.

E. Fiber Content: Ecosolution Q100 Nylon.

F. Pile Characteristic: Multi-level pattern loop.

G. Density: 5797 oz./cu. yd.

H. Thickness: 0.248 inches for finished carpet tile in accordance with ASTM D6859.

I. Stitches: 9 per inch.

J. Gage: 1/12 inch.

K. Tufted Weight: 19 oz./sq. yd. for finished carpet tile.

L. Primary Backing/Backcoating: Manufacturer's standard synthetic.

M. Secondary Backing: Ecoworx Tile.

N. Size: 9 by 36 inches.

O. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

P. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Delamination: Not less than 3.5 lbf/in. > in accordance with ASTM D3936.

3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.

2.3 WALK OFF CARPET TILE (WOC-1)

A. Manufacturers: Subject to compliance with requirements, provide products by the following.

1. Shaw Industries Group, Inc.; Berkshire Hathaway Company.

B. Style: Entree Tile.

C. Color: Match Architect's samples.

D. Pattern: Match Architect's samples.

E. Fiber Content: Pet Polyester.

F. Pile Characteristic: Needlebond Diagonal.

G. Density: 6091 oz./cu. yd.

H. Thickness: 0.348 inches for finished carpet tile in accordance with ASTM D6859.

I. Tufted Weight: 44.5 oz./sq. yd. for finished carpet tile.

J. Primary Backing/Backcoating: Manufacturer's standard polypropylene.

K. Secondary Backing: Ecoworx Tile.

L. Size: 24 by 24 inches.

M. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer’s Inherent Stain Resistance.

N. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Delamination: Not less than 3.5 lbf/in. > in accordance with ASTM D3936.
3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: See Section 096513 “Resilient Base and Accessories.”.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer. Verify the following:

1. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch, protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.

3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 097200 - WALL COVERINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, 8 by 8 inches in size.

C. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.6 QUALITY ASSURANCE

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

1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141 for appearance shading characteristics.

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: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

1. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

a. Flame-Spread Index: 10 or less.
b. Smoke-Developed Index: 120 or less.

2.2 VINYL WALL COVERING (WP-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Momentum P3TEC - South Beach Silk; or comparable product by one of the following:

1. Arc-Com Fabrics, Inc.
2. Designtex; Design Tex Group Inc. (The).
3. Innovations USA.
4. MDC Interior Solutions.
5. Wolf-Gordon Inc.

B. Description: Provide vinyl products in rolls from same production run and complying with the following:

1. ASTM F793/F793M for strippable wall coverings.

a. Category: III, Decorative with High Serviceability.

C. Width: Trim to 48 inches.

D. Backing: Heavy Polyester/Cotton Knit.

E. Repeat: n/a.

F. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.

G. Features:

1. Stain-Resistant Coating.
2. Antimicrobial.
3. Phthalate free.

H. Colors, Textures, and Patterns: As indicated in Architectural drawings.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, 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 bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow plaster to cure for at least 90 days. Neutralize areas of high alkalinity. Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Metals: If not factory primed, clean and apply metal primer as recommended in writing by metal-primer manufacturer and wall-covering manufacturer.
4. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
5. Painted Surfaces:

a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

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

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

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SECTION 098433 - SOUND-ABSORBING WALL UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Sound-absorbing wall panels.
2. Cementitious wood fiber panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Samples for Verification: For each type of product:

1. Core Material: 12-inch- square Sample at corner.

1.3 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 units including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. HVAC.

3. Show operation of hinged and sliding components covered by or adjacent to units.

B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.5 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. Panels: For each type, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.
2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.6 QUALITY ASSURANCE

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

1. Build mockup of portion of 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.
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. Comply with fabric and 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.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install 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 units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Avoid exposure to airborne soiling during initial HVAC operation when contaminants and debris may soil baffle system.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.

PART 2 PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

A. Sound-Absorbing Wall Panel (PET-1 & PET-3):

1. Basis-of-Design: Subject to compliance with requirements, provide MPS Coligo Wall Covering Felt Wall Panels.
2. Panel Shape: Flat.
3. Mounting:

    a. Back mounted with manufacturer's standard adhesive, secured to substrate.

4. Core Material: 100% polyester acoustic felt.
5. Edge Profile: Square.
6. Reveals between Panels: Butt joint.
7. Acoustical Performance: Sound absorption NRC 0.32.
8. Nominal Thickness: 3/8 inch.
9. Panel Width: 46 inches.
10. Panel Height: 119 inches.

B. Sound-Absorbing Wall Panel (PET-2):

1. Basis of Design: Subject to compliance with requirements, provide Wolf-Gordon, Inc.; GATHER Solids or comparable product approved by the Architect.
2. Panel Shape: Flat.
3. Mounting:

    a. Back mounted with manufacturer's standard adhesive, secured to substrate.

4. Reveals Between Panels: Butt joint.
5. Edge Profile: Square.
6. Core Material: 100% polyester acoustic felt.
7. Acoustical Performance: Sound absorption NRC 0.25.
8. Nominal Thickness:1/4 inch.
9. Panel Width: 48 inches.
10. Panel Height: 120.5 inches.

C. Sound-Absorbing Wall Panel (AWP-1):

1. Basis-of-Design: Subject to compliance with requirements, provide Cardinal Acoustics; Direct Attached Panel or comparable product approved by the Architect.
2. Panel Shape: Cardinal Cut Horizontal.
3. Mounting:

    a. Manufacturer standard Mounting D-20.

4. Core Material: Cementitious wood fiber.
5. Edge Profile: Bevel/Square.
6. Reveals between Panels: as selected by Architect from manufacturer's full range.
7. Acoustical Performance: Sound absorption NRC 0.60-0.90.

8. Nominal Thickness: 1 inch.
9. Panel Width: 48 inches.
10. Panel Length: 96 inches.

D. Sound-Absorbing Wall Panel (AWP-2):

1. Basis-of-Design: Subject to compliance with requirements, provide Cardinal Acoustics; Direct Attached Panel or comparable product approved by the Architect.
2. Panel Shape: Custom shape as indicated on Drawings.
3. Mounting:

    a. Manufacturer standard Mounting D-20.

4. Core Material: Cementitious wood fiber.
5. Edge Profile: Bevel/Square.
6. Reveals between Panels: as selected by Architect from manufacturer's full range.
7. Acoustical Performance: Sound absorption NRC 0.60-0.90.
8. Nominal Thickness: 1 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine units and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units 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 manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/8 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/8-inch variation in 48 inches, noncumulative.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION

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SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product Schedule: Use same designations indicated on Drawings and in the exterior painting schedules to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
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.

1.5 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 PAINT PRODUCTS

A. Source Limitations: Obtain each paint product from single source from single manufacturer.

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 topcoat manufacturer for use in paint system and on substrate indicated.

C. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.
4. Rust-Preventive Coatings: 100 g/L.

D. Colors: As indicated in a color schedule.

2.2 PRIMERS

A. Exterior, Alkali-Resistant, Water-Based Primer: Pigmented, water-based primer formulated for use on alkaline surfaces, such as exterior plaster, vertical concrete, and masonry.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); LOXON Concrete & Masonry Primer or comparable product by one of the following:

a. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.

B. Quick-Drying, Alkyd Metal Primer: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, exterior steel surfaces.

2.3 FINISH COATINGS

A. Exterior Latex Paint, Semigloss: Water-based, pigmented emulsion coating formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as masonry, portland cement plaster, and primed wood and metal.

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. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

2. Gloss Level: Manufacturer's standard semigloss finish.

B. Exterior Alkyd Enamel, Semigloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.

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. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

2. Gloss Level: Manufacturer's standard semigloss finish.

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 Concrete Masonry Units): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

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 specified in this Section.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint exterior side and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in the exterior painting schedules may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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 to view:

a. Equipment, including panelboards.
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.

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 instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE, CONCRETE SUBSTRATES

A. Nontraffic Surfaces:

1. Latex System :

a. Prime Coat: Exterior, alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior latex paint, semigloss.

3.7 EXTERIOR PAINTING SCHEDULE, METAL SUBSTRATES

A. Steel and Iron Substrates:

1. Alkyd System :

a. Prime Coat: Alkyd metal primer for bare metal surfaces; Shop primer specified in Section in which substrate is specified for shop primed substrates.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior alkyd enamel, semigloss.

B. Galvanized-Metal Substrates:

1. Latex System :

a. Prime Coat: Water-based, galvanized-metal primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior latex paint, semigloss.

C. Stainless Steel Substrates:

1. Alkyd System :

a. Prime Coat: Vinyl wash primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior alkyd enamel, semigloss.

END OF SECTION

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SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.
4. Floor sealers and paints.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing", Section 051213 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
4. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 PRIMERS

A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of precast concrete and concrete masonry units in preparation for specified subsequent coatings.

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. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

B. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.

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. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

C. Alkyd Quick-Dry Primer for Metal: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, interior steel surfaces.

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. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

2.2 WATER-BASED FINISH COATS

A. Interior, Latex, Institutional Low Odor/VOC, Flat: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Benjamin Moore, Super Hide, Latex Flat 282 or comparable product by one of the following:

a. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard flat finish.

B. Interior, Latex, Institutional Low Odor/VOC, Eggshell: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Benjamin Moore; Ultra Spec 500, Interior Eggshell N538 or comparable product by one of the following:

a. Benjamin Moore & Co.
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.

C. Interior, Latex, High-Performance Architectural Coating, Eggshell: High-performance architectural latex coating providing a significantly higher level of performance than

conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Benjamin Moore - Corotech; Pre-catalyzed waterborne epoxy V342 or comparable product by one of the following:

    a. Benjamin Moore & Co.
    b. PPG Paints; PPG Industries, Inc.
    c. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.

2.3 SOLVENT-BASED FINISH COATS

A. Interior, Alkyd, Semi-Gloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Benjamin Moore - Corotech; Alkyd Urethane Enamel CV201 or comparable product by one of the following:

    a. Benjamin Moore & Co.
    b. PPG Paints; PPG Industries, Inc.
    c. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard semi-gloss finish.

2.4 FLOOR SEALERS AND PAINTS

A. Water-Based Concrete Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

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. PPG Paints; PPG Industries, Inc.
    b. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
    c. Sherwin-Williams Company (The).

2.5 DRY FALL COATINGS

A. Dry Fall, Latex, Flat: Pigmented, water-based, emulsion-type, fast-drying coating for use on interior plaster, concrete, gypsum board, primed wood, and metal ceilings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Benjamin Moore Latex Dry Fall 395 or comparable product by one of the following:

a. PPG Paints; PPG Industries, Inc.
b. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard flat finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. 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 applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 3.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

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 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.
    h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System CONC-1:

a. First Coat: Matching topcoat.
b. Topcoat: Water-based concrete floor sealer.

B. CMU & Precast Concrete Substrates:

1. Institutional Low-Odor/VOC Latex System: PNT-3, PNT-4, PNT-5, PNT-6, PNT-7.

a. Block Filler: Interior/exterior latex block filler.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.Steel Substrates:

2. Water-Based Dry-Fall System PNT-8, PNT-9:

    a. Prime Coat: Alkyd quick-dry primer for metal.
    b. Topcoat: Dry fall, latex, flat.

3. Water-Based Dry Fall over Shop-Applied Quick-Drying Shop Primer System :

    a. Prime Coat: Quick-dry primer for shop application.
    b. Topcoat: Dry fall, latex, flat.

4. Alkyd System PNT-12:

    a. Prime Coat: Alkyd quick-dry primer for metal.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, alkyd, semigloss.

C. Spray-Textured Ceiling Substrates:

1. Latex, Flat System: Spray applied PNT-10:

    a. Prime Coat: Matching topcoat.
    b. Topcoat: Interior, latex, flat.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System: PNT-3, PNT-4, PNT-5, PNT-6, PNT-7.

    a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.

2. Water-Based Pre-Catalyzed Epoxy: PNT-1, PNT-2.

    a. Prime Coat: Interior latex primer sealer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light-industrial coating, eggshell.

E. Acoustic Wall Panels:

1. Institutional Low-Odor/VOC Latex System: PNT-1, PNT-4, PNT-11.

    a. Prime Coat: Matching topcoat.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, institutional low odor/VOC, flat.

END OF SECTION

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SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Wood stains.
3. Transparent finishes.

B. Related Requirements:

1. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

1.2 DEFINITIONS

A. NFHS: National Federation of State High School Associations.

B. MFMA: Maple Flooring Manufacturers Association.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Indicate VOC content.

B. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 MOCKUPS

A. Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals,to demonstrate aesthetic effects,and.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

a. Vertical and Horizontal Surfaces: Provide samples of at least 4 by 12 inches.
b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.

a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

3. 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 not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less than 5 deg F above the dew point, or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations: Obtain each coating product from single source from single manufacturer.

2.2 STAINING AND TRANSPARENT FINISHING

A. Emissions Requirements: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and

Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2. VOC content shall not exceed limits of authorities having jurisdiction and the following:

    a. Shellacs, Clear: 730 g/L.
    b. Stains: 250 g/L.
    c. Clear Wood Finishes (Varnishes, Sanding Sealers, and Lacquers): 275 g/L.

2.3 PRIMERS

A. Sanding Sealer, Interior, Waterborne or Oil-Modified, Clear: Pliable, penetrating type, MFMA Group 1 Sealer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bona AB; SuperSport Clear Seal or comparable product recommended in writing by flooring manufacturer and MFMA approved.

2.4 WOOD STAINS

A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Minwax Company; Performance Series Tintable Wood Stain 250 VOC or comparable product by one of the following:

    a. PPG Paints; PPG Industries, Inc.
    b. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
    c. Sherwin-Williams Company (The).

2.5 MARKER PAINT

A. Game-Line and Marker Paint: Fast drying, water-based enamel compatible with, or recommended in writing by manufacturer of, finish coats, to be finished with a clear varnish.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bona AB; SuperSport Paint or comparable product by one of the following:

    a. Advantage Coatings Technologies.
    b. Endura Manufacturing Company, Ltd.
    c. Poloplaz; A Canlak Coatings Company.

2.6 TRANSPARENT FINISHES

A. Urethane, Interior, Waterborne or Oil Modified, Clear, Gloss: One-component, MFMA Group 3, gymnasium-type surface finishes formulated for gloss finish and multicoat application.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hillyard Diamond 1K Gym Finish or comparable product recommended in writing by flooring manufacturer and MFMA approved.

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 Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

C. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood Substrates, Traffic Surfaces, Including Floors:

1. Clear, Two-Component Polyurethane System (WDF-1):

a. Prime Coat: Sanding sealer, MFMA Group 1.
b. First Intermediate Coat: Two-component urethane matching topcoat.
c. Second Intermediate Coat: Game lines and marker paint according to the requirements of the NFHS and additional designs and/or patterns directed by the Architect.
d. Topcoat: Urethane, MFMA Group 5, gloss.

2. Clear, Two-Component Polyurethane System over Stain System (WDF-2, WDF-3):

a. Prime Coat: Sanding sealer, MFMA Group 1.
b. Stain Coat: Stain, semitransparent, for interior wood.
c. First Intermediate Coat: Two-component urethane matching topcoat.
d. Second Intermediate Coat: Game lines and marker paint according to the requirements of the NFHS and additional designs and/or patterns directed by the Architect.
e. Topcoat: Urethane, MFMA Group 5, gloss.

END OF SECTION

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Visual display board assemblies.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. Include electrical characteristics for motorized units.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.
2. Fabric swatches of fabric facings for tackboards.
3. Actual factory-finish color samples, applied to aluminum substrate.
4. Include accessory Samples to verify color selected.

D. Product Schedule: For visual display units.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each visual display unit, for tests performed by a qualified testing agency.

B. Sample Warranties: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units 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.

1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: 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:

a. 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 VISUAL DISPLAY BOARD ASSEMBLIES

A. Visual Display Board Assemblies:.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Claridge Products and Equipment, LLC.
b. Egan Visual.
c. ghent; a GMi Company.
d. Magna Visual Corp.
e. Peter Pepper Products, Inc.

B. Visual Display Board Assembly: factory fabricated.

1. Assembly: markerboard.
2. Corners: Square.

3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

F. Combination Assemblies: Provide manufacturer's standard exposed trim between abutting sections of visual display panels.

G. Chalktray: Manufacturer's standard; continuous.

1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

2.2 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.3 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Hardboard: ANSI A135.4, tempered.

C. Particleboard: ANSI A208.1, Grade M-1.

D. MDF: ANSI A208.2, Grade 130.

E. Fiberboard: ASTM C208 cellulosic fiber insulating board.

F. Extruded Aluminum: ASTM B221, Alloy 6063.

G. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500 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 unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

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

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. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display units.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. 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, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies:

1. Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height for Grades K through 3: 24 inches above finished floor to top of chalktray.
2. Mounting Height for Grades 4 through 6: 28 inches above finished floor to top of chalktray.
3. Mounting Height for Grades 7 and Higher: 36 inches above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION

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SECTION 101200 - DISPLAY CASES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Display cases.

1.2 DEFINITIONS

A. Display Case: Glazed cabinet with adjustable shelves.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Display cases.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases. Include furnished specialties and accessories.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of tackboard panels, header panel and factory-finished trim involving color finish selection.

D. Samples for Verification: For each type of exposed finish for the following:

1. Trim: 6-inch- long sections of each trim profile.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For display cases to include in maintenance manuals.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install display cases for indoor installations 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.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain display cases from single source from single manufacturer.

2.2 DISPLAY CASES

A. Basis-of-Design Product: Subject to compliance with requirements, provide The Waddell Display Collection by Ghent - Recessed Display Case; or comparable product by one of the following:

1. Claridge Products and Equipment, LLC.
2. ghent; a GMi Company.
3. Peter Pepper Products, Inc.
4. Waddell; a GMi Company.
5. Other as Approved by Architect.

B. Recessed Display Case: Factory-fabricated display case; with finished interior, operable glazed doors at front, and trim on face to cover edge of recessed opening.

1. Display Case Cabinet: Extruded aluminum.
2. Face Frame:

    a. Aluminum.

3. Aluminum Finish: Clear anodic.

C. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.

1. Thickness: Not less than Manufacturers standard thick.
2. Number of Doors: Two.

D. Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.

1. Shelf Depth: 12 inches.
2. Number of Shelves: Four.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112; recess mounted in rear surface. Provide standards extending full height of display case.

F. Back Panel: Laminate.

1. Color: White.

G. Size: 48 inches high, 60 inches wide, by 16 inches deep.

2.3 MATERIALS

A. Particleboard: ANSI A208.1, Grade M-1.

B. Hardwood Plywood: HPVA HP-1.

C. Extruded-Aluminum Bars and Shapes: ASTM B221, Alloy 6063.

D. Aluminum Tubing: ASTM B429/B429M, Alloy 6063.

E. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

F. High-Pressure Plastic Laminate: ISO 4586-3.

G. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

2.4 FABRICATION

A. Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500 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 unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper backing for display cases.

C. Examine walls and partitions for suitable framing depth if recessed units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

3.3 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Mounting Height: As indicated in drawings.

B. Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches o.c.

C. Install display case shelving level and straight.

3.4 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended in writing by manufacturer.

B. Touch up factory-applied finishes to restore damaged areas.

END OF SECTION

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dimensional characters.

a. Cast dimensional characters.
b. Cutout dimensional characters.
c. Molded-plastic dimensional characters.

1.2 DEFINITIONS

A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.3 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size Sample of each type of dimensional character.
2. Exposed Accessories: Half-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

E. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Molded-Plastic Characters: Injection molded or thermoformed characters having uniform faces and profiles, and as follows:

1. Color: Manufacturer's standard process, in color as selected by Architect from manufacturer's full range.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless steel or hot-dip galvanized devices unless otherwise indicated.
3. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match Architect's sample color unless otherwise indicated.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features 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.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that electrical service is correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate and install washers and nuts on stud ends projecting through opposite side of surface and tighten.

3. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

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SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Half-Size digital mock-up of each signage type.
2. Variable Component Materials: 2-inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
3. Exposed Accessories: 2-inch Sample of each accessory type.

E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design",and,ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ACE Sign Systems, Inc.
b. Diskey Sign Company
c. Vomar Products, Inc

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
b. Color(s): As selected by Architect from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.
b. Corner Condition in Elevation: Rounded to radius indicated.

4. Mounting: Manufacturer's standard method for substrates indicated with two-face tape.
5. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Adhesive: As recommended by sign manufacturer.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls according to the accessibility standard.

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 101423 - PANEL SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary informational and directional signs.
2. Section 101423.16 "Room-Identification Panel Signage" for room-identification signs that are directly attached to the building.
3. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
4. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
5. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
6. Section 265213 "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

B. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Panel signs.
2. Field-applied, vinyl-character signs.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Not less than 12 inches square, including corner.
2. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.
3. Variable Component Materials: 8-inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
4. Exposed Accessories: Half-size Sample of each accessory type.
5. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs 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. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
2. Tools: One set of specialty tools for assembling signs and replacing variable sign components.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

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

B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

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.

2.2 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Steel Materials:

1. Metallic-Coated Steel Sheet: ASTM A653/A653M, G90 coating, either commercial or forming steel.
2. Steel Members Fabricated from Plate or Bar Stock: ASTM A529/A529M or ASTM A572/A572M, 42,000-psi minimum yield strength.
3. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

E. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

F. Fiberglass Sheet: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.

G. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.

H. PVC Sheet: Manufacturer's standard, UV-light stable, PVC plastic.

I. Plastic-Laminate Sheet: ISO 4586-3, Grade HGS.

J. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

K. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless steel or hot-dip galvanized devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant slots unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
    c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

5. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design

load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing signs with imposed loads to structure.
2. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Adhesive: As recommended by sign manufacturer.

E. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

F. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

G. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into indicated sign surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

2. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
3. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.
4. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.

C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image is to be free of rough edges.

D. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

F. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match Architect's sample color unless otherwise indicated.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

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

B. Color Anodic Finish: AAMA 611, 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. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 METALLIC-COATED STEEL FINISHES

A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.

B. Factory Prime Finish: After cleaning and pretreating, apply an air-dried primer compatible with the organic coating to be applied over it.

C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

2.8 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.

1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.

C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

2.9 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. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Directional Satin Finish: No. 4.
3. Dull Satin Finish: No. 6.
4. Reflective, Directional Polish: No. 7.
5. Mirrorlike Reflective, Nondirectional Polish: No. 8.

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. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

D. Verify that electrical service is correctly sized and located to accommodate signs.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until

spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate and install washers and nuts on stud ends projecting through opposite side of surface and tighten.

3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.
7. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
8. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.
9. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using method specified above.

D. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

E. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign and two-face tape.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show overhead support or bracing locations.

C. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.

1. Size: Manufacturer's standard size.

D. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: One bumper(s) with associated fasteners.
4. Door Pull: One door pull(s) with associated fasteners.
5. Fasteners: 10 fasteners of each size and type.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.

C. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Cover all plastic components with a protective plastic masking.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

B. Project Conditions: 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 SOURCE LIMITATIONS

A. Obtain plastic toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", ICC A117.1, and Minnesota Council on Disability for toilet compartments designated as accessible.

2.3 SOLID-PLASTIC TOILET COMPARTMENTS (TP-1)

A. Basis-of-Design: Subject to compliance with requirements, provide Scranton Products; Hiny Hiders or comparable product by one of the following:

1. All American Metal Corp.
2. ASI Global Partitions.
3. Bradley Corp.

B. Toilet-Compartment Style: Floor Mounted Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color throughout thickness of material.

1. Color: One color in each room as selected by Architect from manufacturer's full range.

E. Urinal-Screen Construction: Matching panel construction.

F. Pilaster Shoes: Manufacturer's standard design; stainless steel.

G. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.

H. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe matching that on the pilaster.

I. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum.

J. Hardware and Accessories:

1. Door Hardware and Accessories: Manufacturer's operating hardware and accessories.
2. Hinges:

a. Manufacturer's paired, wraparound, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.

1) Material, Paired Hinge: Aluminum.

3. Latch and Keeper: Manufacturer's surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.

a. Material: Manufacturer’s standard.

4. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.

a. Material: Manufacturer's standard.

5. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.

a. Material: Manufacturer's standard.

6. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

a. Material: Manufacturer's standard.

K. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

L. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

M. Materials:

1. Aluminum Castings: ASTM B26/B26M.
2. Aluminum Extrusions: ASTM B221.
3. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
4. Stainless Steel Castings: ASTM A743/A743M.
5. Zamac: ASTM B86, commercial zinc-alloy die castings.

N. Fabrication:

1. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

2. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
3. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
4. Urinal-Screen Posts: Manufacturer's standard corrosion-resistant anchoring assemblies at posts and walls, with leveling adjustment nuts at bottoms of posts. Provide shoes at posts to conceal anchorage.
5. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet enclosures and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible.

2.4 FULL HEIGHT SOLID-PLASTIC TOILET COMPARTMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products; Aria Partitions - Traditional 1000 Series Door and Panel or comparable product by one of the following:

1. As approved by Architect.

B. Toilet-Enclosure Style: Floor-and-ceiling anchored, privacy type.

C. Entrance-Screen Style: Floor-and-ceiling anchored.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color throughout thickness of material. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's continuous, extruded-aluminum, or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color: One color in each room as selected by Architect from manufacturer's full range.

E. Entrance-Screen Construction: Matching panel construction.

F. Pilaster Shoes: Manufacturer's standard design; solid plastic.

1. Plastic Color: Matching pilaster.

G. Pilaster Sleeves (Caps): Manufacturer's standard design; solid plastic.

1. Plastic Color: Matching pilaster.

H. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design.

I. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid plastic.

J. Hardware and Accessories:

1. Door Hardware and Accessories: Manufacturer's operating hardware and accessories with occupancy indicators.
2. Hinges:

    a. Helix style 78 inches edge mounted continuous hinge.

        1) Stainless teel: 0.074 inch thick 304-2B stainless steel using a stainless-steel pin 0.234 inch diameter.
        2) Doors shall swing to a partially open position.

3. Occupancy Indicator Latch and Housing: Satin stainless-steel showing green and red occupancy indicators.

    a. Latch Housing: Satin stainless steel.
    b. Slide bolt and button: Satin stainless steel.
    c. Door Pulls: Satin stainless steel.

4. Coat Hook and Bumper:

    a. Combination type, chrome plate Zamak.
    b. Equip outswing handicapped doors with second door pull and door stop.

K. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

L. Materials:

1. Aluminum Castings: ASTM B26/B26M.
2. Aluminum Extrusions: ASTM B221.
3. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
4. Stainless Steel Castings: ASTM A743/A743M.
5. Zamac: ASTM B86, commercial zinc-alloy die castings.

M. Fabrication:

1. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
2. Floor-and-Ceiling-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

3. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, outswinging doors for standard toilet enclosures and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible and ambulatory.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch.
b. Panels or Screens and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust, so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

E. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust, so doors are level and aligned with panels, when doors are in closed position.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return to a partially open position.

END OF SECTION

SECTION 102213 - WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard-duty wire mesh partitions.

1.2 DEFINITIONS

A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.

B. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Wire mesh partitions.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Indicate clearances required for operation of doors and gates.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for units with factory-applied color finishes.

D. Samples for Verification: Panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

1. Size: 12 by 12 inches.

E. Delegated Design Submittals: For wire mesh partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Welding certificates.

B. Qualification Statements: For Installer.

C. Delegated design engineer qualifications.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wire mesh partition hardware.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.
2. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

a. AWS D1.1/D1.1M.
b. AWS D1.3/D1.3M.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire mesh items with cardboard protectors on perimeters of panels and doors and with posts wrapped to provide protection during transit and Project-site storage. Use vented plastic.

B. Inventory wire mesh partition door hardware on receipt and provide secure lockup for wire mesh partition door hardware delivered to Project site.

1. Tag each item or package separately with identification and include basic installation instructions with each item or package.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

PART 2 PRODUCTS

2.1 WIRE MESH PARTITIONS

A. Basis-of-Design Product: Subject to compliance with requirements, provide WireCrafters; Style 840 or comparable product by one of the following:

1. American Wire Corporation.
2. Jesco Industries, Inc.
3. Standard Wire & Steel Works.

2.2 SOURCE LIMITATIONS

A. For wire mesh products, obtain each color, grade, finish, type, and variety from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wire mesh units.

B. Structural Performance: Wire mesh units to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft. at any location on a panel.
2. Total load of 200 lbf applied uniformly over each panel.
3. Concentrated load and total load need not be assumed to act concurrently.

C. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for doors and gates designated as accessible.

2.4 STANDARD-DUTY WIRE MESH PARTITIONS

A. Mesh: 0.135-inch- diameter, intermediate-crimp steel wire woven into 1-1/2-inch diamond mesh.

B. Vertical Panel Framing: 1-1/4-by-5/8-by-0.080-inch cold-rolled, C-shaped steel channels with holes for 1/4-inch- diameter bolts not more than 12 inches o.c.

C. Horizontal Panel Framing: 1-by-1/2-by-1/8-inch cold-rolled steel channels.

D. Horizontal Panel Stiffeners: Two cold-rolled steel channels, 3/4 by 3/8 by 1/8 inch, bolted or riveted toe to toe through mesh; or one 1-by-1/2-by-1/8-inch cold-rolled steel channel with wire mesh woven through channel.

E. Top Capping Bars: 2-1/4-by-1-inch cold-rolled steel channels.

F. Posts for 90-Degree Corners: 1-1/4-by-1-1/4-by-1/8-inch steel angles or square tubes with holes for 1/4-inch- diameter bolts aligning with bolt holes in vertical framing; with floor anchor clips.

G. Adjustable Corner Posts: Two 1-1/4-by-5/8-by-0.080-inch cold-rolled, C-shaped steel channels connected by steel hinges at 36 inches o.c., with holes for 1/4-inch- diameter bolts aligning with bolt holes in vertical framing.

H. Line Posts: 3-inch-by-4.1-lb or 3-1/2-by-1-1/4-by-0.127-inch steel channels; with 1/4-inch steel base plates.

I. Floor Shoes: Metal, not less than 2 inches high; sized to suit vertical framing, drilled for attachment to floor, and with setscrews for leveling adjustment.

J. Sliding Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch steel channels or 1-1/4-by-5/8-by-0.080-inch cold-rolled, C-shaped steel

channels, banded with 1-1/4-by-1/8-inch flat steel bar cover plates on four sides, and with 1/8-inch- thick angle strike bar and cover on strike jamb.

1. Hardware: Two, four-wheel roller-bearing carriers; box track; and bottom guide channel for each door.
2. Cylinder Lock: Mortise type with cylinder specified in Section 087100 "Door Hardware"; operated by key outside and lever inside.
3. Inactive Leaf Hardware: Cane bolt at bottom and chain bolt at top.

K. Accessories:

1. Adjustable Filler Panels: 0.060-inch- thick, steel sheet; capable of filling openings from 2 to 12 inches.
2. Wall Clips: Manufacturer's standard, steel sheet; allowing up to 1 inch of adjustment.

L. Finish: Powder-coated finish unless otherwise indicated.

1. Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Wire: ASTM A510/A510M.

C. Steel Plates, Channels, Angles, and Bars: ASTM A36/A36M.

D. Steel Sheet: Cold-rolled steel sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.

E. Steel Pipe: ASTM A53/A53M, Schedule 40, unless another weight is indicated or required by structural loads.

F. Steel Tubing: ASTM A500/A500M, cold-formed structural-steel tubing or ASTM A513/A513M, Type 5, mandrel-drawn mechanical tubing.

G. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.

H. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.

I. Post-Installed Anchors: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

J. Power-Driven Fasteners: ICC-ES AC70.

K. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

L. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.

M. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.6 FABRICATION

A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.

1. Fabricate wire mesh items to be readily disassembled.
2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.

B. Standard-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Securely clinch mesh to framing.
2. Framing: Fabricate framing with mortise-and-tenon corner construction.

    a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
    b. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with 3 to 4 inches of clear space between finished floor and bottom horizontal framing.
4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
5. Doors: Align bottom of door with bottom of adjacent panels.

    a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.

6. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

2.7 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean items of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop Priming: Apply shop primer to uncoated surfaces of wire mesh units unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

D. Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard enamel finish, suitable for use indicated, with a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

E. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine floors for suitable conditions where wire mesh items will be installed.

C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WIRE MESH PARTITIONS

A. Anchor wire mesh partitions to floor with 3/8-inch- diameter, postinstalled expansion anchors at 12 inches o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.

B. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing and as follows:

1. For concrete and solid masonry anchorage, use expansion anchors.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

C. Secure top capping bars to top framing channels with 1/4-inch- diameter, "U" bolts spaced not more than 28 inches o.c.

D. Provide line posts at locations indicated or, if not indicated, as follows:

1. On each side of sliding-door openings.
2. For partitions that are 7 to 9 ft. high, spaced at 15 to 20 ft. o.c.
3. For partitions that are 10 to 12 ft. high, located between every other panel.

E. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.

F. Install doors complete with door hardware.

G. Bolt accessories to wire mesh partition framing.

3.3 REPAIR

A. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas are included in Section 099123 "Interior Painting."

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

3.4 ADJUSTING

A. Adjust gates to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Verify that latches and locks engage accurately and securely without forcing or binding.

3.5 PROTECTION

A. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.

END OF SECTION

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SECTION 102239 - FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operable acoustical panel partitions.
2. Operable fire-rated panel partitions.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
2. Section 092900 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.

1.2 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Operable acoustical panel partitions.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, attachment details.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Panel Facing Material: Manufacturer's standard-size unit, not less than 6 inches square.
2. Panel Edge Material: Not less than 3 inches long.

1.4 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. Partition track, track supports and bracing, switches, turning space, and storage layout.
2. Suspended ceiling components.
3. Structural members to which suspension systems will be attached.

B. Setting Drawings: For embedded items and cutouts required in other work.

C. Qualification Data: For Installer.

D. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

E. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
b. Seals, hardware, track, track switches, carriers, and other operating components.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance in accordance with ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance in accordance with ASTM C423, and rated for not less than the NRC indicated.

B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:

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

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

2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested in accordance with NFPA 265 Method B Protocol,or,NFPA 286.

2.2 OPERABLE ACOUSTICAL PANEL PARTITIONS

A. Operable Acoustical Panel Partitions: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

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. KWIK-WALL Company.

b. Moderco Inc.
c. Modernfold, Inc.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Standard widths.

E. STC: Not less than 52.

F. Panel Weight: 11 lb/sq. ft. maximum.

G. Panel Thickness: Nominal dimension of 3 inches.

H. Panel Closure: Manufacturer's standard unless otherwise indicated.

1. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

I. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

J. Finish Facing: Vinyl-coated fabric wall covering.

2.3 SEALS

A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:

1. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous, resilient acoustical seal.

C. Horizontal Top Seals: Continuous-contact, resilient seal exerting uniform constant pressure on track.

D. Horizontal Bottom Seals:

1. Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

a. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 1-1/2 inches between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
2. Match facing pattern 72 inches above finished floor.

B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with WA-101, Type II-Medium Duty; Class A.

1. Color/Pattern: As selected by Architect from manufacturer's full range.

C. Paint: Manufacturer's standard factory-painted finish.

1. Color: As selected by Architect from manufacturer's full range.

D. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:

1. Steel, Painted: Finished with manufacturer's color as selected by Architect from manufacturer's full range.

E. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum mounted directly to overhead structural support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket

supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6 ACCESSORIES

A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.

1. Manufacturer's standard method to secure storage pocket door in closed position.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF OPERABLE PANEL PARTITIONS

A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

B. Install panels in numbered sequence indicated on Shop Drawings.

C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust storage pocket doors to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.

3.4 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include six months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

3.5 DEMONSTRATION

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

END OF SECTION

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SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall guards.
2. Corner guards.
3. Special Wall Protection.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Wall Guards: 3 inches long. Include examples of joinery, corners, end caps, and field splices.
2. Corner Guards: 3 inches long.
3. Abuse-Resistant Wall Covering: 6 by 6 inches square.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Guard Covers: Full-size plastic covers of maximum length equal to 5 percent of each type, color, and texture of cover installed, but no fewer than two, 96-inch- long units.
2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2,5 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- long units.
3. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection 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 65 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.
b. Store wall-guard covers in a horizontal position.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-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 including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 WALL GUARDS

A. Crash Rail: Standard-duty assembly consisting of continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CS Acrovyn 4000 SCR-64M or comparable product by one of the following:

a. Construction Specialties, Inc.
b. inpro Corporation.
c. Koroseal Interior Products, LLC.

2. Cover: Extruded rigid plastic, minimum 0.080-inch thickness; as follows:

a. Profile: Flat with factory formed top and bottom radius, nominal 8 inches high by 1-1/4 inch deep.
b. Color and Texture: As selected by Architect from manufacturer's standard range.

3. Continuous Retainer: Minimum 0.080-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
6. Accessories: Concealed splices and mounting hardware.
7. Mounting: Surface mounted directly to wall.

2.4 CORNER GUARDS

A. Surface-Mounted, Opaque-Plastic Corner Guards (CG-1): Fabricated as one piece from PVC plastic; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Construction Specialties, Inc.
b. inpro Corporation.
c. Koroseal Interior Products, LLC.

2. Wing Size: Nominal 1-1/2 by 1-1/2 inches.

3. Mounting: Adhesive.
4. Color and Texture: As selected by Architect from manufacturer's standard range.

2.5 SPECIAL WALL PROTECTION

A. Stainless Steel Sheet (STL-1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties; Stainless Steel Sheet or comparable product by one of the following:

    a. Construction Specialties, Inc.
    b. inpro Corporation.
    c. Koroseal Interior Products, LLC.
    d. Kwalu, LLC.
    e. Other Architect Approved Alternate.

2. Size: 48 inches by 96 or 120 inches.
3. Sheet Thickness: 0.060 inch.
4. Color and Texture: Stainless Steel #4 Satin Finish with standard Smooth Texture.
5. Height: Full wall.
6. Mounting: Mechanical Fasteners or Adhesive as recommended by manufacturer.

B. Fiberglass Reinforced Plastic (FRP-1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites Glasbord or comparable product by one of the following:

    a. Marlite.
    b. Other Architect Approved Alternate.

2. Size: 48 inches by 96 or 120 inches.
3. Sheet Thickness: 0.09 inch (embossed), 0.075 inch (smooth).
4. Color and Texture: Gray, Smooth.
5. Height:

    a. Food Preparation Areas: Full wall.
    b. Mop Sinks: 48 inch wainscot.

6. Mounting: Mechanical Fasteners or Adhesive as recommended by manufacturer.
7. Moldings: Polypropylene/PVC moldings.
8. Caulk: Color Rite Color Sil caulk, color matched to wall panel.

2.6 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Metal Materials: 16-Gauge stainless steel sheet, satin finish with smooth texture.

C. 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.

D. Adhesive: As recommended by protection product manufacturer.

2.7 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and 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.

2.8 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door 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 wall and door protection attached with adhesive, 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 wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

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

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Childcare accessories.
4. Custodial accessories.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: Wall Mounted Soap Dispensers, Wall Mounted Paper Towel Dispensers, and Toilet Tissue Dispensers as indicated in drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 360 lbf concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.

B. Soap Dispenser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley 6334 Lavatory-Mounted Soap Dispenser or comparable product by one of the following:

    a. ASI-American Specialties, Inc.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
3. Mounting: Deck mounted on lavatory.
4. Capacity: 16 oz.
5. Materials:

    a. Plunger & Flange: Heavy Chrome-plated brass.
    b. Shank: Molded clear ABS plastic.
    c. Pump Assembly: molded clear ABS plastic.
    d. Valve Components: Celcon, Buna-N rubber or stainless steel.
    e. Soap Bottle: Translucent polyethylene. 16 oz capacity.

C. Grab Bar:

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. ASI-American Specialties, Inc.
    b. Bobrick Washroom Equipment, Inc.

c. Bradley Corporation.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. OD: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

D. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; Satin Finish Surface Mounted Napkin Disposal 4781-11 or comparable product by one of the following:

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Surface mounted.
3. Door or Cover: Continuous hinged, disposal-opening cover.
4. Receptacle: Removable liners.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

E. Mirror Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; 781 Series Channel-Frame Mirror or comparable product by one of the following:

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Frame: Stainless steel channel.

a. Corners: Manufacturer's standard.

3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

F. Hook:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick; Surface-Mounted Coat Hook with Bumper B-9541 or comparable product by one of the following:

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.

c. Bradley Corporation.

2. Description: Combination door bumper and coat hook.
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Adjustable-Height Adult Changing Station:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Koala Kare; KB3000-AHL or comparable product by one of the following:

a. Foundations Worldwide, Inc.
b. Pressalit Inc.
c. Smirthwaite USA LLC; Prism Medical Group.

2. Description: Height-adjustable horizontal unit that is electrically operated with wired hand control and with safety rail.

a. Engineered to support minimum of 500 lb static load when opened.

3. Mounting: Surface mounted, foldable by pneumatic shock-absorbing mechanism.
4. Electrical Characteristics: Manufacturer's standard actuator and control system, with integrated 24 V dc transformer, powered by single 120 V electrical receptacle.
5. Material and Finish: Changing Surface shall be polyethylene and meet IK10 standard for resistance to high impact and sharp objects.

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

B. Shower Curtain Rod:

1. 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. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: 1-1/4-inch- OD, straight rod.
3. Configuration: As indicated on Drawings.
4. Mounting Flanges: Concealed fasteners; in manufacturer's standard material and finish.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Shower Curtain:

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. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Size: Minimum 6 inches wider than opening by 72 inches high.
3. Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat:

1. 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. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Dimensions: Seat 33-in. wide, projects 22-in from wall.

E. Soap Dish:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schluter; Shelf-E Shower, Triangular 'Wave' Pattern or comparable product by one of the following:

a. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
b. Seachrome Corporation.
c. Gatco.
d. Hansgrohe.

2. Description: wall mounted, with the following features:

a. Wall Shelf consisting of 4mm thick shelves for installation with tile on wall surfaces.

3. Material and Finish: Brushed Stainless Steel Type 304 Equals V2A.

F. Robe Hook:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Liberty Hardware; 3-in. Heavy duty double robe hook B423021 or comparable product by one of the following:

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
d. Seachrome Corporation.
e. Liberty Hardware.
f. Amerock Hardware.

2. Description: Double-prong unit.
3. Material and Finish: Polished chrome-plated zinc alloy (zamac).

2.5 CHILDCARE ACCESSORIES

A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.

B. Diaper-Changing Station:

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. ASI-American Specialties, Inc.
b. Bradley Corporation.
c. Foundations Worldwide, Inc.
d. Koala Kare Products; Bobrick Washroom Equipment, Inc.

2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

a. Engineered to support minimum of 200 lb static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color.
6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.6 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder:

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. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
    b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.7 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

D. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

E. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.8 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION OF TOILET, BATH, AND LAUNDRY ACCESSORIES

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

    1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for portable fire extinguishers.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.
2. Section 211000 "Water-Based Fire-Suppression Systems" for fire-hose connections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.5 INSPECTION SERVICE:

A. Extinguishers shall have an inspection certification tag attached, indicating date of charge and service agent’s name and address. Charge date shall not be earlier than sixty days prior to Date of Substantial Completion. Service agent shall be located within 50 miles of project.

B. Provide an inspection service agreement for inspection and servicing of extinguishers for one year following date of initial charge, as well as for servicing and recharging extinguishers

failing to hold charge within the initial one-year period. Recharging extinguishers due to use or vandalism shall not be included in service agreement.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. JL Industries; Activar Construction Products Group, Inc.
2. Larsen's Manufacturing Company, Architectural Series.
3. Potter Roemer LLC; a Division of Morris Group International.

B. Fire-Protection Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Nonrated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: 20 ga. Cold-rolled steel sheet, prefinished in manufacturer’s standard white baked enamel.

1. Shelf: Same metal and finish as cabinet.

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. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

F. Cabinet Trim Material: 20 ga. Cold-rolled steel, baked enamel coating suitable for receipt of field paint finish.

G. Door Material: Roll formed, one piece tubular construction from 20 ga. Cold rolled steel sheet, baked enamel coating suitable for receipt of field paint finish.

H. Door Style: Solid opaque panel with frame.

I. Door Hardware: Manufacturer's standard full length piano hinge, roller catch.

J. 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. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER" in size, color, and vertical or horizontal orientation as selected by Architect.

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.
5. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below.

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
4. Fire-Rated Cabinets:

    a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
    b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

C. Identification:

1. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."
2. Section 233813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. JL Industries; Activar Construction Products Group, Inc.
b. Larsen's Manufacturing Company.
c. Potter Roemer LLC; a Division of Morris Group International.

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 5-B:C, 5-lb and 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

1. Accessories: Pressure gauge, hose, and nozzle.
2. Operation: Pull-pin and squeeze grip for multiple controlled release.

C. Carbon Dioxide Type : UL-rated 10-B:C, 10-lb nominal capacity, with carbon dioxide in manufacturer's standard enameled-aluminum container.

1. Accessories: Hose and nozzle.
2. Operation: Pull-pin and squeeze grip.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard wall bracket designed to support extinguisher securely in vertical position on wall or centered in cabinet.

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical or Horizontal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.
2. Mounted in Cabinets: Install using wall mounting bracket attached to back on cabinet.

C. Install all extinguishers in plumb, vertical position with name and operating instructions visible on front of extinguisher.

3.3 CLEANING AND PROTECTION

A. Protect installed equipment and finished surfaces from damage or defacement. Replace items which cannot be repaired to satisfaction of Architect.

B. Prior to date of Substantial Completion, clean and polish all surfaces, including cabinet interiors.

3.4 EXTINGUISHER SCHEDULE:

A. Provide 10 lb. extinguishers in semi-recessed mounted cabinets in locations as indicated.

B. Provide one 10 lb. extinguisher and wall bracket mounted in each mechanical, electrical, equipment, and storage room.

END OF SECTION

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SECTION 105113 - METAL LOCKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Knocked-down athletic lockers.
2. Locker benches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Sustainable Design Submittals:

C. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

E. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers and equipment.
2. Locker benches.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Locks.
b. Blank identification plates.
c. Hooks.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

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 metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain metal lockers and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers and locker benches indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", and,ICC A117.1.

2.3 KNOCKED-DOWN ATHLETIC LOCKERS

A. Perforated Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.

B. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch nominal thickness, with single bend at edges.
2. Backs: 0.048-inch nominal thickness.
3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

C. Perforated Sides: Fabricated from 0.060-inch nominal-thickness steel sheet with manufacturer's standard diamond perforations.

D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet or 0.097-inch nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames for Double-Tier Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

E. Reinforced Bottoms: Structural channels, formed from 0.060-inch nominal-thickness steel sheet; welded to front and rear of side-panel frames.

F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.
2. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

G. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Single-Point Latching: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

I. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

J. Coat Rods: Manufacturer's standard.

K. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.

1. Closed Front and End Bases: Fabricated from 0.048-inch nominal-thickness steel sheet.

L. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: Vertical-end type.

M. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

N. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

O. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.4 LOCKER BENCHES

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. ASI Storage Solutions.
2. Lyon LLC.
3. Salsbury Industries.

B. Provide bench units with overall assembly height of 17-1/2 inches.

C. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick except provide 20- to 24-inch-wide tops where accessible benches are indicated.
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

D. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel:

a. 1-1/2-inch- diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
b. Color: As selected by Architect from manufacturer's full range.

E. Materials:

1. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
2. Plastic Laminate: ISO 4586-3, Grade HGP.
3. Extruded Aluminum: ASTM B221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
4. Steel Tube: ASTM A500/A500M, cold rolled.
5. Particleboard: ANSI A208.1, Grade M-2.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers by preassembling at plant prior to shipping, using manufacturer's nuts, bolts, screws, or rivets.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

H. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
2. Attach sloping-top units to metal lockers, with closures at exposed ends.
3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

E. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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SECTION 105116 - WOOD LOCKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-faced wood lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wood locker and bench.

B. Shop Drawings: For wood lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in lockers.

C. Samples for Verification: For the following products:

1. Solid wood with transparent finish, not less than 5 by 24 inches, for each species and cut, finished on one side and one edge - if available.

1.3 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. Units of the following locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Hooks.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location and comply with requirements specified in "Field Conditions" Article.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wood lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where wood lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that wood lockers can be supported and installed as indicated.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of locks and other hardware.
c. Deterioration of wood, wood finishes, and other materials beyond normal use.

2. Warranty Period: two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 WOOD-FACED WOOD LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sprogs Five-Section Toddler Locker, 36.75”H x 15”D x 54”W, with seat offset - or comparable product by one of the following:

1. Classic Woodworking, LLC.

2. Club Resource Group.
3. Hollman, Inc.
4. Ideal Products, Inc.
5. Treeforms.
6. Other Architect Approved.

B. Construction Style: Manufacturer's standard.

C. Final Assembly: Manufacturer's standard factory, or, knocked-down assembly.

D. Locker Body: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.

1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch thick.
2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch thick.
3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch thick.
4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch thick.
5. Exposed Panel Edges: Solid wood to match doors.

E. End Panels: Match style, material, construction, and finish of wood-faced wood doors.

F. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; fixed.

1. Thickness: 5/8 inch.
2. Exposed Edges: Solid wood to match doors.

G. Grain Matching: Run and match grain vertically for doors and fixed panels.

H. Veneer Matching:

1. None required; select and arrange veneers for compatible grain and color.

I. Transparent Finish: Manufacturer's standard two-coat, clear, catalyzed lacquer finish with sanding between coats. Seal with moisture-resistant topcoat.

1. Stain: None required.

J. Factory finish wood lockers as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

1. Preparations for Finishing: Sand, fill countersunk fasteners, seal concealed surfaces, and perform similar preparations for finishing lockers, as applicable to each unit of the Work.

2.3 MATERIALS

A. Solid Wood: Clear hardwood lumber, selected for compatible grain and color.

B. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2.
2. Softwood Plywood: DOC PS.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

C. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

D. Anchors: Material, type, size, and finish as required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.4 HARDWARE

A. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; chrome finished. Attach hooks with at least two fasteners.

1. Provide two double-prong wall hooks for each compartment of open-front lockers.

B. Exposed Hardware Finish:

1. Polished chrome unless otherwise indicated.
2. Unless otherwise indicated, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

a. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on face frames.

B. Install lockers level, plumb, and true; use concealed shims.

C. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.

D. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.

E. Locker Anchorage:

1. Fasten lockers through wood locker base, at ends, and not more than 36 inches o.c. with No. 8 brass-finished, flush-head wood screws sized for 1-inch penetration into wood base.
2. Fasten lockers through back, near top and bottom, at ends with No. 8 pan-head sheet metal screws through metal backing or metal framing behind wall finish and spaced not more than 16 inches o.c.

3.4 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cooking appliances.
2. Kitchen exhaust ventilation.
3. Refrigeration appliances.
4. Cleaning appliances.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for kitchen sinks, dishwasher air-gap fittings, waste (garbage) disposers, and instant hot-water dispensers.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Cooking appliances.
2. Kitchen exhaust ventilation.
3. Refrigeration appliances.
4. Cleaning appliances.

B. Product Data Submittals: For each product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

C. Sustainable Design Submittals:

1. Product Data: For indicated products, indicating compliance with requirements for ENERGY STAR product labeling.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of appliance.

B. Sample Warranties: For manufacturers' special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 60 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.6 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Electric Cooktop and Range: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on surface-burner elements.

1. Warranty Period: Five years from date of Substantial Completion.

C. Microwave Oven: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service.

1. Warranty Period: Two years from date of Substantial Completion.

D. Refrigerator/Freezer, Freezer, and Icemaker, Sealed System: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.

1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
2. Warranty Period for Other Components: Two years from date of Substantial Completion.

E. Dishwasher: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.

1. Warranty Period for Deterioration of Tub and Metal Door Liner: Three years from date of Substantial Completion.
2. Warranty Period for Other Components: Two years from date of Substantial Completion.

F. Clothes Washer: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain residential appliances from single source and each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 COOKING APPLIANCES

A. Electric Range: Freestanding range with one oven.

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. Frigidaire.
    b. GE Appliances; Haier Group.
    c. Maytag; Whirlpool Corporation.
    d. Whirlpool Corporation.

2. Width: 30 inches.
3. Electric Burner Elements: Four.

    a. Radiant Type: Two 1500 W and two 2000 W.
    b. Controls: Digital panel controls, located on splash panel at rear of rangetop.

4. Oven Features:

    a. Capacity: 3.3 cu. ft.
    b. Operation: Baking.
    c. Broiler: Located in top of oven.
    d. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
    e. Electric Power Rating:

        1) Oven(s): Manufacturer's standard.
        2) Broiler: Manufacturer's standard.

    f. Controls: Digital panel controls and timer display, located on splash panel at rear of rangetop.

5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
7. Material: Porcelain-enameled steel with ceramic-glass cooktop.

    a. Color/Finish: White.

B. Drop-in Electric Range: Drop-in range with one oven(s) and complying with AHAM ER-.

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. Frigidaire.
    b. GE Appliances; Haier Group.
    c. Maytag; Whirlpool Corporation.
    d. Whirlpool Corporation.

2. Width: 30 inches.
3. Electric Burner Elements: Four.

    a. Radiant Type: Two 1500 W and two 2000 W.
    b. Controls: Digital panel controls, located on front.
    c. ADA Compliant.

4. Oven Features:

    a. Capacity: 3.3 cu. ft.
    b. Operation: Baking.
    c. Broiler: Located in top of oven.
    d. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
    e. Electric Power Rating:

        1) Oven(s): Manufacturer's standard.
        2) Broiler: Manufacturer's standard.

    f. Controls: Digital panel controls and timer display, located on front.
    g. ADA Compliant.

5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
7. Material: Porcelain-enameled steel with ceramic-glass cooktop.

    a. Color/Finish: White.

C. Gas Range: Freestanding range with one oven(s).

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. Frigidaire.
    b. GE Appliances; Haier Group.
    c. Kenmore; Transformco SR Brands LLC.
    d. Maytag; Whirlpool Corporation.
    e. Whirlpool Corporation.

2. Gas Burners: Four.

    a. Power Ratings: Manufacturer's standard.
    b. Controls: Manual-dial controls, located on front.
    c. Grates: Individual.

3. Oven Features:

    a. Capacity: 4.8 cu. ft. or greater.
    b. Operation: Baking.
    c. Broiler: Located in top of oven.
    d. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
    e. Gas Power Ratings:

        1) Oven(s): Manufacturer's standard.
        2) Broiler: Manufacturer's standard.

    f. Controls: Digital panel controls and timer display, located on splash panel at rear of rangetop.

4. Anti-Tip Device: Manufacturer's standard.
5. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
6. Material: Porcelain-enameled steel with manufacturer's standard cooktop.

    a. Color/Finish: White.

D. Microwave Oven:

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. Frigidaire.
    b. GE Appliances; Haier Group.
    c. Maytag; Whirlpool Corporation.
    d. Whirlpool Corporation.

2. Mounting: Countertop.
3. Type: Conventional.
4. Dimensions:

    a. Width: No more than 24 inches.
    b. Depth: No more than 18 inches.
    c. Height: No more than 14 inches.

5. Capacity: Not more than 1.7 cu. ft.
6. Oven Door: Door with observation window and pull handle.
7. Microwave Power Rating: 1100 W.
8. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
9. Controls: Digital panel controls and timer display.

10. Other Features: Turntable.
11. Material: Manufacturer's standard.

    a. Color/Finish: White.

2.4 KITCHEN EXHAUST VENTILATION

A. Overhead Exhaust Hood:

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. Amana; Whirlpool Corporation.
    b. Frigidaire.
    c. GE Appliances; Haier Group.
    d. Maytag; Whirlpool Corporation.
    e. Whirlpool Corporation.

2. Type: Undercabinet exhaust-hood system.
3. Dimensions:

    a. Width: 30 inches.

4. Exhaust Fan: Two-speed fan built into hood and with manufacturer's standard capacity.

    a. Venting: As indicated on Drawings.
    b. Fan Control: Hood-mounted fan switch, with separate hood-light control switch.

5. Duct Type: Manufacturer's standard.
6. Finish: Baked enamel.

    a. Color: White.

7. Features:

    a. Permanent, washable filter(s).
    b. Built-in lighting.

B. ADA Overhead Exhaust Hood:

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. Amana; Whirlpool Corporation.
    b. Frigidaire.
    c. GE Appliances; Haier Group.
    d. Maytag; Whirlpool Corporation.
    e. Whirlpool Corporation.

2. Type: Undercabinet exhaust-hood system.
3. Dimensions:

    a. Width: 30 inches.

4. Exhaust Fan: Two-speed fan remotely located, with separate housing and with manufacturer's standard capacity.

    a. Venting: As indicated on Drawings.
    b. Fan Control: Wall-mounted fan switch, with separate hood-light control switch.

5. Duct Type: As indicated on Drawings.
6. Finish: Baked enamel.

    a. Color: White.

7. Features:

    a. Permanent, washable filter(s).
    b. Built-in lighting.

2.5 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer: Two-door, side-by-side refrigerator/freezer.

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. Frigidaire.
    b. GE Appliances; Haier Group.
    c. Maytag; Whirlpool Corporation.
    d. Whirlpool Corporation.

2. Type: Freestanding.
3. Dimensions:

    a. Width: 36 inches.
    b. Depth: Not more than 36 inches with handles.
    c. Height: 70 inches.

4. Storage Capacity:

    a. Refrigeration Compartment Volume: 16.6 cu. ft.
    b. Freezer Volume: 9 cu. ft.
    c. Shelf Area: adjustable shelves, 25.6 cu. ft.

5. General Features:

    a. Dual refrigeration systems.
    b. Separate temperature controls for each compartment.

6. Front Panel(s): Manufacturer's standard.

    a. Panel Color: White.

7. Appliance Color/Finish: White.

2.6 CLEANING APPLIANCES

A. Dishwasher: Complying with AHAM DW-1.

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. Frigidaire.
    b. GE Appliances; Haier Group.
    c. Maytag; Whirlpool Corporation.
    d. Whirlpool Corporation.

2. Type: Built-in undercounter.
3. Dimensions:

    a. Width: 24 inches.
    b. Depth: Manufacturers standard, +/- 24 inches.
    c. Height: 32-1/4 inches.

4. Sound Level: Maximum 51 dB.
5. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.
6. Rack System: Nylon-coated sliding dish racks, with removable cutlery basket.
7. Controls: Touch-pad controls with three wash cycles and hot-air and heat-off drying cycle options.
8. Features:

    a. Waste food disposer.
    b. Self-cleaning food-filter system.
    c. Hot-water booster heater for 140 deg F wash water with incoming water at 100 deg F.
    d. Heated Dry.

9. Front Panel: Manufacturer's standard.

    a. Panel Color: White.

10. Appliance Color/Finish: White.

B. Clothes Washer: Complying with AHAM HLW-1.

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. GE Appliances; Haier Group.
b. LG Electronics USA, Inc.; LG Electronics Inc.
c. Maytag; Whirlpool Corporation.
d. Whirlpool Corporation.

2. Type: Freestanding, front-loading unit.
3. Dimensions:

    a. Width: 27 inches.
    b. Depth: 31 inches.
    c. Height: 39 inches.

4. Drum: Perforated stainless steel.

    a. Capacity: 4.5 cu. ft.

5. Controls: Rotary-dial controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.

    a. Wash Cycles: Four wash cycles, including regular, delicate, and permanent press.
    b. Wash Temperatures: Three settings.
    c. Speed Combinations: Two.

6. Electrical Power: 120 V, 60 Hz, 1 phase, 15 A.
7. Motor: Manufacturer's standard with built-in overload protector.
8. Features:

    a. Self-cleaning lint filter.
    b. Unbalanced-load compensator.
    c. Inlet Hoses: Minimum length 60 inches.
    d. Drain Hoses: Minimum length 48 inches.
    e. Self-leveling legs.
    f. Automatic dispenser for detergent.
    g. Spin-cycle safety switch.
    h. End-of-cycle signal.
    i. Extra-rinse option.
    j. Electronic temperature control.
    k. Water levels automatically set.

9. Appliance Finish: Enamel.

    a. Color: White.

10. Front-Panel Finish: Manufacturer's standard.

    a. Panel Color: White.

C. Clothes Dryer: Complying with AHAM HLD-1.

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. GE Appliances; Haier Group.
    b. LG Electronics USA, Inc.; LG Electronics Inc.
    c. Maytag; Whirlpool Corporation.
    d. Whirlpool Corporation.

2. Type: Freestanding, frontloading, electric unit.
3. Dimensions:

    a. Width: 27 inches.
    b. Depth: 31 inches.
    c. Height: 39 inches.

4. Drum: Perforated stainless steel.

    a. Capacity: 7.0 cu. ft.

5. Controls: Rotary-dial controls for drying cycle, temperatures, and fabric selectors.
6. Electric-Dryer Power: 240 V, 60 Hz, 1 phase, 30 A.
7. Features:

    a. Removable lint filter.
    b. Electronic temperature and moisture-level-sensor controls.
    c. End-of-cycle signal.
    d. Interior drum light.
    e. Self-leveling legs.

8. Appliance Finish: Enamel.

    a. Color: White.

9. Front-Panel Finish: Manufacturer's standard.

    a. Panel Color: White.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Perform the following 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.

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

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment for installation by Contractor.

1.2 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:

1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Insulated floors.
5. Floor areas with positive slopes to drains.
6. Floor sinks and drains serving foodservice equipment.
7. Roof curbs, equipment supports, and penetrations.

1.3 ACTION SUBMITTALS

A. Product Data.

1. Fabricated equipment.
2. Cooking equipment.
3. Self-contained refrigeration equipment.
4. Powered food-preparation equipment.

B. Include the following:

1. Manufacturer's model number.
2. Accessories and components that will be included for Project.
3. Clearance requirements for access and maintenance.
4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For foodservice facilities.

1. Indicate locations of foodservice equipment and connections to utilities.
2. Key equipment using same designations as indicated on Drawings.
3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
4. Include details of seismic bracing for equipment.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Product Schedule: For each foodservice equipment item, include the following:

1) Designation indicated on Drawings.
2) Manufacturer's name and model number.
3) List of factory-authorized service agencies including addresses and telephone numbers.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.7 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 54, "National Fuel Gas Code."
3. NFPA 70, "National Electrical Code."
4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

2.2 FABRICATED EQUIPMENT

A. Stainless Steel Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Regency 71-inch 16 Gauge Stainless Steel One Compartment Commercial Sink with Galvanized Steel Legs and 2 Drainboard" or comparable product by one of the following:

a. Elkay.
b. Steelton.
c. Regency.

2. Description: One-compartment sink(s). Fabricate units of welded stainless steel, sound deadened.

a. Bowls: Stainless steel, Type 304, 0.062 inch thick.
b. Integral Drainboards: Stainless steel, Type 304, 0.062 inch thick.
c. Body: Stainless steel, Type 304, 0.062 inch thick.

1) Back Splash: Manufacturer's standard height.
2) Side Splash: Manufacturer's standard height.

d. Legs and Feet: Stainless steel tubing legs with adjustable bullet feet.

3. Stainless Steel Sheet: ASTM A240/A240M, austenitic stainless steel, type as indicated.
4. Stainless Steel Finish: Directional satin finish, ASTM A480/A480M, No. 4.

B. Stainless Steel Tables:

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. Regency.
b. Steelton.

2. Description: Prep table.

a. Tops: Stainless steel, Type 304, 0.062 inch thick, reinforced and sound deadened.

1) Back Splash: Manufacturer's standard height.
2) Edge: Bullnose on front edge, straight on sides and back.

b. Welded Undershelf: Stainless steel, Type 304, 0.050 inch thick.
c. Legs: Stainless steel tubing.
d. Feet: Stainless steel, flanged, adjustable bullets.

3. Materials:

a. Stainless Steel Sheet: ASTM A240/A240M, austenitic stainless steel, type as indicated.
b. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with minimum G90 coating.

4. Stainless Steel Finish: Directional satin finish, ASTM A480/A480M, No. 4.

C. Stainless Steel Shelf Units:

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. Regency.
b. Steelton.
c. Insert Manufacturers Name.

2. Description: Wall mounted. Fabricate units of stainless steel, Type 304, 0.062 inch thick.
3. Stainless Steel Sheet: ASTM A240/A240M, austenitic stainless steel, type as indicated.
4. Stainless Steel Finish: Directional satin finish, ASTM A480/A480M, No. 4.

2.3 COOKING EQUIPMENT

A. Ranges:

1. Manufacturers: Subject to compliance with requirements, basis of design; Wells WVOG136 Ventless Cooking System with Convection Oven Base. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. As approved by Architect.

2. Description:

a. Top Configuration:

1) Griddle: Flat.

b. Base Configuration:

1) Convection Oven(s): One.
2) Storage Base: One.

c. Accessories:

1) Self-contained, 4-stage filtration system.
2) Self-contained fire protection system.
3) Stainless steel sides.
4) Stainless steel back.
5) Front Legs: Adjustable 6 to 8 inches.
6) Toe Base: 4 inches high.
7) Casters: 6 inch rear mounted rigid casters.
8) Oven Rack(s): One for each oven.

d. Electrical Service: Equip unit for connection to service indicated on Drawings.

2.4 SELF-CONTAINED REFRIGERATION EQUIPMENT

A. Refrigeration Equipment: Refrigerators.

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. True.
b. Beverage-Air.
c. Avantco.

2. Description: Reach-in type.

a. Exterior Finish: Stainless steel.
b. Interior Finish: Manufacturer's standard.
c. Doors: Full length.
d. Accessories:

1) Casters.
2) Re-hinging feature for doors.
3) Adjustable epoxy coated or chrome plated shelves.

e. Electrical Service: Equip unit with plug and cord for service indicated on Drawings.

2.5 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

1. Public Health and Safety Requirements:

a. Sealant is certified for compliance with NSF standards for end-use application indicated.

b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

2.6 FINISHES

A. 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.

B. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless steel equipment until smooth and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

D. Install cabinets and similar equipment on bases in a bed of sealant.

E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain foodservice equipment.

END OF SECTION

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SECTION 115213 - PROJECTION SCREENS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, front-projection screens.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal support framing for front-projection screens.
2. Section 061000 "Rough Carpentry" for wood backing for screen installation.

1.2 DEFINITIONS

A. ALR: Ambient-light rejection; for specular reflective viewing surfaces, measured as the percentage of ambient light striking the viewing surface that has equal angles of incidence and reflection.

B. Gain: Ratio of light reflected from viewing-surface material to that reflected perpendicularly from a magnesium carbonate surface as determined in accordance with SMPTE RP 94.

C. Half-Gain Angle: The angle, measured from the axis of the viewing surface to the most central position on a perpendicular plane through the horizontal centerline of the viewing surface, where the gain is half of the peak gain.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:

1. Drop heights.
2. For end-mounted motors, location of screen centerline relative to ends of screen case.
3. Anchorage details, including connection to supporting structure for suspended units.
4. Details of juncture of screen case or trim with adjacent finishes.
5. For electrically operated units, wiring diagrams and location of wiring connections.
6. Accessories.

C. Samples: For each type of exposed finish and for each color and finish specified, in manufacturer's standard sizes.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver front-projection screens until spaces are enclosed and weathertight, wet-work in installation spaces is complete and dry, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions planned for building occupants during the remainder of the construction period.

B. Store front-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.6 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC system components, fire-suppression system, and partitions.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain viewing surfaces and accessories, including mounting hardware, from screen manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Viewing-Surface and Masking Materials:

1. Mildew-Resistance Rating: Zero or 1 when tested in accordance with ASTM G21.
2. Flame Resistance: Passes NFPA 701.
3. Flame-Spread Index: Not greater than 75 when tested in accordance with ASTM E84.

2.3 MANUALLY OPERATED, FRONT-PROJECTION SCREENS

A. General Requirements: Manufacturer's standard spring-roller-operated units, consisting of case, flexible screen, mounting accessories, and other components necessary for a complete installation.

1. Screen Mounting: Top edge securely anchored to a rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.

B. Metal-Encased, Manually Operated Screen: Unit with free-hanging screen; with screen case fabricated from formed-steel sheet or aluminum extrusions with manufacturer's standard finish and matching end caps.

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. Alltec Screens; a brand of Alltec Pro.
b. Draper, Inc.
c. Legrand AV Inc.; Legrand North America, LLC.

2. Surface-Mounting Configuration: Mounted using manufacturer's standard projecting wall brackets.
3. Screen Case Color: As selected by Architect from manufacturer's standard options.
4. Matte Viewing Surface: White, 1.0 minimum peak gain and 60-degree minimum half-gain angle.
5. Edge Treatment: Without black masking borders.
6. Size of Viewing Surface: As indicated in schedule on Drawings,40 by 64 inches,50 by 80 inches,40-1/2 by 72 inches,57-1/2 by 92 inches,45 by 80 inches,52 by 92 inches.
7. Extra Drop Height: As needed at top of screen for bottom of screen to be 36 inches above floor.

a. Color: Black.

2.4 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General Requirements: Manufacturer's standard units, consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by Underwriters Laboratories Inc. (UL) or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a metal rod, with ends of rod protected by plastic caps.

B. Surface-Mounted, Metal-Encased, Electrically Operated Screen: Motor-in-roller unit with screen case fabricated from formed-steel sheet or from aluminum extrusions with manufacturer's standard finish and matching end caps.

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. Alltec Screens; a brand of Alltec Pro.
b. Draper, Inc.
c. Legrand AV Inc.; Legrand North America, LLC.
d. Screen Innovations.
e. Stewart Filmscreen.

2. Motor in Roller: Instant-reversing motor of size and capacity recommended in writing by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
3. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

a. Provide with one control switch.
b. Provide power supply for low-voltage systems if required.
c. Provide locking cover plates for switches.
d. Provide key-operated, power-supply switch.
e. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.

4. Surface-Mounting Configuration: Mounted using manufacturer's standard projecting wall brackets.
5. Screen-Case Color: As selected by Architect from manufacturer's standard options.
6. Free-Hanging, Matte Viewing Surface: White, 1.0 minimum peak gain and 60-degree minimum half-gain angle.

    a. Edge Treatment: Without black masking borders.

7. Size of Viewing Surface: 50 by 80 inches,57-1/2 by 92 inches,87-1/2 by 140 inches,45 by 80 inches,79 by 140 inches.
8. Extra Drop Height: As needed at top of screen for bottom of screen to be 36 inches above floor.

    a. Color: Black.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated on Drawings to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor them to supporting substrate in a manner that produces a smoothly operating screen that, when lowered, has flat viewing surface and plumb vertical edges.

1. Install low-voltage controls in accordance with NFPA 70 and complying with manufacturer's written instructions.

    a. Wiring Method: Install wiring in raceway, except in accessible ceiling spaces and in gypsum board partitions, where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables, except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

END OF SECTION

SECTION 116623 - GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basketball equipment.
2. Volleyball equipment.
3. Exercise equipment.
4. Mat storage equipment.
5. Safety pads.

B. Related Requirements:

1. Section 096466 "Wood Athletic Flooring" for game lines and markers.
2. Section 096566 "Resilient Athletic Flooring" for game lines and markers.
3. Section 116653 "Gymnasium Dividers" for gymnasium divider curtain systems.

1.2 DEFINITIONS

A. NFHS: National Federation of State High School Associations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include assembly, disassembly, and storage instructions for removable equipment.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, and operational clearances.
3. Include transport and storage accessories for removable equipment.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each item and color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved:

1. Structural members to which overhead-supported gymnasium equipment will be attached.

2. Suspended ceiling components, if any.
3. Items supported from building structure above the courts, including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Smoke detectors.
    f. Acoustical treatments or panels.

B. Setting Drawings: For embedded items and cutouts required in other work.

C. Qualification Data: For Installer.

D. Product Certificates: For each type of gymnasium equipment.

E. Field quality-control reports.

F. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Basketball backboard failures, including glass breakage.
    b. Faulty operation of basketball backstops.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 BASKETBALL EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Performance Sports Systems; Model 3107 or comparable product by one of the following:

1. Bison, Inc.
2. Draper, Inc.
3. Porter Athletic Equipment Company.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Standard Rules: Provide equipment according to the requirements of NFHS's "Basketball Rules Book."

D. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

E. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

F. Overhead-Supported Backstops:

1. Folding Type: Manufacturer's standard assembly for forward-folding, front-braced backstop, with hardware and fittings to permit folding.
2. Framing: Steel pipe, tubing, and shapes designed to minimize vibration during play.

a. Center-Mast Frame: Welded with side sway bracing.
b. Finish: Manufacturer's standard primer for field finishing.

G. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.

H. Backstop Electric Operator: Provide operating machine of size and capacity recommended in writing by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
3. Motor Electrical Characteristics:

a. Horsepower: 3/4 hp.
b. Voltage: 115 V ac, single phase, 60 hertz.

4. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.

    a. Group Key Switch Control Stations: One switch per two backstops.
    b. Keys: Provide two keys per station.
    c. Switches, Ganged: Single faceplate with multiple switch cutouts for three switches operating six backstops.

5. Limit Switches: Adjustable switches at each backstop, interlocked with motor controls and set to automatically stop backstop at fully retracted and fully lowered positions.

I. Basketball Backboards:

1. Shape and Size:

    a. Rectangular, 72 by 42 inches width by height, with rounded corners.

2. Backboard Material: Provide with predrilled holes or preset inserts for mounting goals, and as follows:

    a. Glass: Minimum 1/2-inch- thick, transparent tempered glass according to ASTM C1048Kind FT (fully tempered) and with impact-testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing.

        1) Frame: Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backstop.
        2) Direct Mount: Designed for mounting backboard frame to center mast of backstop, to maximize stress relief on backboard frame and glass.
        3) Rim-Restraining Device: According to NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.

3. Target Area and Border Markings for Clear Tempered Glass: Permanently etched in white color, marked in pattern and stripe width according to referenced standard rules.

J. Goal-Mounting Assembly: Compatible with goal, backboard, and backstop; with manufacturer's standard hole pattern for goal attachment.

1. Glass Backboard Goal-Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backstop and to minimize stresses on glass backboard.

K. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced standard rules.
2. Type:

a. Fixed: Nonmovable.

3. Net Attachment: No-tie loops for attaching net to ring without tying.
4. Finish: Manufacturer's standard finish.

L. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit ring diameter, and as follows:

1. Competition Cord: Antiwhip, made from white nylon cord, minimum 120-gm thread and maximum 144-gm thread.

M. Backboard Safety Pads: Designed for backboard thickness and extending continuously along bottom and up sides of backboard and over backstop as required by referenced standard rules.

1. Attachment: Manufacturer's standard.
2. Color: As selected by Architect from manufacturer's full range.

2.2 VOLLEYBALL EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Performance Sports Systems; Model 8101R or comparable product by one of the following:

1. Bison, Inc.
2. Draper, Inc.
3. Porter Athletic Equipment Company.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Standard Rules: Provide equipment according to the requirements of NFHS's "Volleyball Rules Book."

D. Overhead-Supported Post System:

1. Folding Type: Manufacturer's standard assembly for braced, folding post system, with hardware and fittings to permit folding.
2. Framing: Steel pipe, tubing, and shapes designed to minimize vibration during play.

a. Post Frame: Welded with side sway bracing.
b. Finish: Manufacturer's standard primer for field finishing.

E. Post Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.

F. Post Electric Operator: Provide operating machine of size and capacity recommended in writing by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
3. Motor Electrical Characteristics:

    a. Horsepower: 3/4 hp.
    b. Voltage: 115 V ac, single phase, 60 hertz.

4. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.

    a. Group Key Switch Control Stations: One switch per post system.
    b. Keys: Provide two keys per station.
    c. Switches, Ganged: Single faceplate with multiple switch cutouts for three switches operating six backstops.

5. Limit Switches: Adjustable switches at each post system, interlocked with motor controls and set to automatically stop backstop at fully retracted and fully lowered positions.

G. Net: 32 feet long; one per pair of paired post standards; and as follows:

1. Width and Nylon Mesh: Competition volleyball net, 39 inches with 4-inch- square mesh made of black nylon string.
2. Dowels: Minimum 1/2-inch- diameter fiberglass or 1-inch- diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.
3. Net Antennas: 3/8-inch- diameter, high-tensile-strength, extruded-fiberglass or plastic rods, 72 inches long, extending above top hem band of net, with alternating white and red bands according to referenced standard rules. Provide two antennas per net.

    a. Clamps: Designed to secure antenna to top and bottom of net.

H. Net-Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip, manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Mount net tensioner on post standard at side away from court. Provide end post with post top pulley. Provide opposing post with welded-steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.

I. Judges' Stands: Manufacturer's standard units designed to be attached to and supported by post standard. Fabricate welded-steel tubing units with finish and color to match post standards.

J. Safety Pads: Consisting of minimum 1-inch- thick, multiple-impact-resistant manufacturer's standard foam filler covered by puncture- and tear-resistant fabric cover, manufacturer's standard; with fire-test-response characteristics indicated. Provide pads with hook-and-loop closure or attachments for the following components:

1. Fabric Color: As selected by Architect from full range of industry standard colors and color densities.

2.3 MAT STORAGE EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Jaypro Sports, LLC; Securelift Wall-mounted Double Mat Hoist MHWM-D-A or comparable product by one of the following:

1. Bison, Inc.
2. Draper, Inc.
3. Porter Athletic Equipment Company.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

D. Mat Hoist Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; two per hoist system.

E. Backstop Electric Operator: Provide operating machine of size and capacity recommended in writing by manufacturer for equipment specified, with dual electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
3. Motor Electrical Characteristics:

    a. Horsepower: 1 hp.
    b. Voltage: 115 V ac, single phase, 60 hertz.

4. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.

    a. Group Key Switch Control Stations: One switch per hoist system.
    b. Keys: Provide two keys per station.
    c. Switches, Ganged: Single faceplate with multiple switch cutouts for three switches operating six backstops.

5. Limit Switches: Adjustable switches at each backstop, interlocked with motor controls and set to automatically stop backstop at fully retracted and fully lowered positions.

2.4 SAFETY PADS

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. Bison, Inc.
2. Draper, Inc.
3. Jaypro Sports, LLC.
4. Performance Sports Systems.
5. Porter Athletic Equipment Company.

B. Source Limitations: Obtain from single source from single manufacturer.

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

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

D. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, minimum 14-oz./sq. yd. and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

E. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board, with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

1. Backer Board: Minimum 3/8-inch- thick fire-retardant-treated plywood by pressure process according to AWPA U1, Use Category UCFA Fire Retardant Interior.
2. Fill: Multiple-impact-resistant foam, minimum 1-1/2-inch- thick bonded polyurethane, 6.0-lb/cu. ft. density.
3. Size: Each panel section as indicated on Drawings.
4. Number of Modular Panel Sections: As indicated on Drawings.
5. Installation Method: Manufacturer's standard.
6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for two color(s).
7. Graphics: Custom graphics as indicated on Drawings.

F. Cutout Trim: Manufacturer's standard flanged cutout trim kits for fitting pads around switches, receptacles, and other obstructions.

2.5 MATERIALS

A. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings according to the wire rope manufacturer's written instructions for size, number, and installation method.

B. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy-steel chains, according to ASTM A391/A391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.

C. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, according to ASTM A413/A413M (Grade 30 proof coil chain or higher grade recommended by gymnasium equipment manufacturer). Provide coating type, chain size, number, and installation method according to manufacturer's written instructions.

D. Castings and Hangers: Malleable iron, according to ASTM A47/A47M; grade as required for structural loading.

E. Composite Wood Products: Products shall be made without urea formaldehyde.

F. Softwood Plywood: DOC PS 1, exterior.

G. Particleboard: ANSI A208.1.

H. Equipment-Mounting Board: Wood, neutral-color-painted finish; size and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

I. Anchors, Fasteners, Fittings, and Hardware: Gymnasium equipment manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

J. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, according to ASTM C1107/C1107M, with minimum strength recommended in writing by gymnasium-equipment manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure, subfloors, and footings below finished floor.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions and competition rules for each type of gymnasium equipment.

B. Install gymnasium equipment after other finishing operations, including painting, have been completed unless otherwise indicated.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relationship to adjacent construction; and aligned with court layout.

1. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

E. Connections: Connect electric operators to building electrical system.

F. Removable Gymnasium-Equipment Components: Assemble in place to verify that equipment and components are complete and in proper working order. Disassemble removable gymnasium equipment after assembled configuration is approved by Owner, and store units in location indicated on Drawings.

3.3 INSTALLATION OF SAFETY PADS

A. Mount with bottom edge at dimension indicated on Drawings above finished floor.

B. Cutout Trim: Limit cuts in face of padding so that cuts are securely and fully concealed behind trim-kit flange.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform visual inspections and operational tests as recommended by referenced standard rules of each sport and the equipment manufacturer.
2. Test rebound elasticity of basketball goals.
3. Test basketball goal pressure-release characteristics and adjustability.

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

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

3.6 DEMONSTRATION

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

END OF SECTION

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SECTION 116653 - GYMNASIUM DIVIDERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fold-up divider systems.
2. Electric operators.
3. Divider curtains.
4. Divider system accessories.
5. Ball barrier netting.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium dividers.

1. Include plans showing alignment of curtains in relation to sport-court layout and overhead structural supports.
2. Include elevations, sections, details, and attachments to other work.
3. Include system clearances, stacking requirements, and limits for fitting into adjacent construction.
4. Include point loads and locations for attachment of gymnasium dividers to structure.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each item and color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans with divider-curtain layouts, 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 to which divider-curtain systems will be attached.
2. Suspended ceiling components, if any.
3. Items supported from building structure, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Smoke detectors.
f. Acoustical treatments or panels.

B. Product Certificates: For each type of gymnasium divider.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium dividers to include in operation and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium dividers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gymnasium dividers.
b. Tearing or deterioration of fabric, seams, or other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 FOLD-UP DIVIDER SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Performance Sports Systems; Model 4020 or comparable product by one of the following:

1. Draper, Inc.
2. Jaypro Sports, LLC.
3. Porter Athletic Equipment Company.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Divider-Curtain System: Electrically operated, upward folding, cable suspended, and as follows:

1. Top Hem: Double-thickness mesh or solid vinyl for continuous pipe batten.
2. Outer Edge Hems: Triple turned and welded.
3. Bottom Curtain Pocket: 6 inches with manufacturer's standard pipe batten with padding.
4. Grommets: Manufacturer's standard material, size, and spacing; for lift cables to pass through curtain fabric.
5. Support Cables: 1/8-inch- diameter galvanized-stranded-steel wire rope with a breaking strength of 2000 lb. Provide fittings according to cable manufacturer's written instructions for size, type, number, and installation method.
6. Support Chain and Fittings: Hardened alloy-steel chain rated for lifting loads indicated, with commercial-quality, corrosion-resistant steel connectors and hangers.

7. Curtain Battens and Drive Pipe: Fabricate from steel pipe or tubing with a minimum number of joints, as necessary for required lengths. Provide galvanized battens and drive pipe, or shop prime and shop finish with black paint.

2.2 ELECTRIC OPERATORS

A. Provide factory-assembled electric operation system of size and capacity recommended in writing and provided by gymnasium divider manufacturer for gymnasium dividers specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.

1. Include wiring from control stations to motors and between synchronizer and dual motors for long curtains. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

B. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Motor Electrical Characteristics:

1. Horsepower: 1 hp.
2. Voltage: 115 V ac, single phase, 60 hertz.

D. Limit Switches: Adjustable switches at each divider curtain, interlocked with motor controls and set to automatically stop divider curtain at fully extended and fully retracted positions.

E. Control System:

1. Key-Switch Operation: NEMA ICS 6, Type 1 enclosure, momentary-contact, three-position switch-operated control with up, down, and off functions.

a. Group Key-Switch Control: One switch per each curtain.
b. Switches, Ganged: Single faceplate with multiple switch cutouts as indicated on Drawings.
c. Keys: Provide two key(s) per station.

2.3 DIVIDER CURTAINS

A. Upper Curtain, Mesh: Woven mesh of polyester yarn coated with vinyl, weighing not less than 9 oz./sq. yd.

1. Mesh Color: As selected by Architect from full range of industry colors and color densities.

B. Lower Curtain, Solid: Woven polyester fabric coated with vinyl, 19 oz./sq. yd., 8-foot height above floor.

1. Fabric Color(s): Two color(s), as selected by Architect from full range of industry colors and color densities.

C. Hems: Folded and electronically welded.

D. Seams: Electronically welded.

E. Overall Curtain Height: Floor to ceiling, within installation clearances required.

F. Bottom of Curtain: Approximately 2 inches above finished floor.

2.4 DIVIDER SYSTEM ACCESSORIES

A. Safety Lock: Locks drive system when speed exceeds manufacturer's recommended speed.

B. Audible Motion Alarm: Provide alarm with intermittent warning tone when curtain is raised or lowered.

C. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80, heat-treated alloy-steel chains, according to ASTM A391/A391M, with commercial-quality, hot-dip galvanized steel connectors and hangers.

D. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, according to ASTM A413/A413M, Grade 30 proof coil chain or higher grade recommended by gymnasium divider manufacturer. Provide coating type, chain size, number, and installation method according to manufacturer's written instructions.

E. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal-resistant design.

2.5 BALL BARRIER NETTING

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. Carron Net Company, Inc.
2. US Netting.
3. West Coast Netting.

B. Netting:

1. Gauge: Nylon not more than #21 (approx. 1.6 mm diameter).
2. Knot Spacing: Not more than 1.75 inches square.
3. Edge Binding: Nets are edge bordered with 5/16 poly rope binding on all edges.
4. Color: Black.

C. Installation Hardware: Cable assembly for suspending and drawing the nets, including turnbuckles, 1/4 inch (6 mm) galvanized steel cable, cable clamps, and thimbles. Contractor to provide eye bolts/anchors of whatever type appropriate for wall type where cable assembly is to be installed. Attachment hardware to be determined by application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Install gymnasium dividers after other finishing operations, including painting, have been completed unless otherwise indicated.

C. Install gymnasium dividers level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with sport-court layout.

1. Verify clearances for movable components of gymnasium dividers throughout entire range of operation and for access to operating components.

D. Electric Operators Installation: Connect electric operators to building electrical system.

3.3 ADJUSTING

A. Adjust movable components of gymnasium dividers to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, uneven tension, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

B. Limit Switch Adjustment: Set and adjust upper and lower limit controls.

3.4 DEMONSTRATION

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

END OF SECTION

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SECTION 116823 - EXTERIOR COURT ATHLETIC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes playground equipment as follows:

1. Exterior basketball equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish.

1. Manufacturer's color charts.
2. Include Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of playground equipment.

B. Material Certificates: For the following items:

1. Shop finishes.

C. Setting Drawings: For embedded items and cutouts required in other work.

D. Sample Warranty: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment 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 metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 EXTERIOR BASKETBALL EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Bison; 5" Ultimate Jr. Basketball Hoop PR17 or comparable product by one of the following:

1. Draper, Inc.
2. First Team, Inc.
3. Porter Athletic Equipment Company.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Standard Rules: Provide equipment according to the requirements of NFHS's "Basketball Rules Book."

D. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

E. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

F. Pole-Mounted Backstops:

1. Stationary Type: Manufacturer's standard square-tube assembly for stationary backstop.
2. Framing: Steel pipe, tubing, and shapes designed to minimize vibration during play.

a. Finish: Manufacturer's standard polyester powder-coat finish.

3. Extension Arm: 3 feet extension arm from center mast with adjustable bolted-connection bracket for height adjustability.

G. Basketball Backboards:

1. Shape and Size:

a. Rectangular, 72 by 42 inches width by height, with rounded corners.

2. Backboard Material: Provide with predrilled holes or preset inserts for mounting goals, and as follows:

a. Steel: Single-piece, steel face sheet, minimum 0.1046-inch (2.7-mm) nominal thickness, with 1-1/2-inch- (38-mm-) deep, roll-edged perimeter flange and with steel-reinforced, welded frame welded to back side of backboard; with mounting slots for mounting backboard frame to backstop at standard mounting centers.

3. Target Area and Border Markings for Opaque Surfaces: Marked in pattern, stripe width, and color according to referenced standard rules.
4. Finish: Manufacturer's standard factory-applied, white background.

H. Goal-Mounting Assembly: Compatible with goal, backboard, and backstop; with manufacturer's standard hole pattern for goal attachment.

1. Direct Mount: Designed for mounting goal directly and independently to center mast of backstop, so that no force is transmitted by ring directly to backboard, and rigidity and stability of goal are maximized.

I. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced standard rules.
2. Type:

a. Fixed: Nonmovable.

3. Net Attachment: No-tie loops for attaching net to ring without tying.
4. Finish: Manufacturer's standard finish.

J. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit ring diameter, and as follows:

1. Competition Cord: Antiwhip, made from white nylon cord, minimum 120-gm thread and maximum 144-gm thread.

K. Backboard Safety Pads: Designed for backboard thickness and extending continuously along bottom and up sides of backboard and over backstop as required by referenced standard rules.

1. Attachment: Manufacturer's standard.
2. Color: As selected by Architect from manufacturer's full range.

2.2 MATERIALS

A. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated.

B. Post Caps: color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

C. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

D. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, according to ASTM C1107/C1107M, with minimum strength recommended in writing by gymnasium-equipment manufacturer.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties:

1. Comply with requirements in Section 033000 "Cast-in-Place Concrete" and ACI 301/ (ACI 301M) for normal-weight concrete with minimum 28-day compressive strength of 3000 psi (20.7 MPa), 3-inch (76-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions and competition rules for each equipment type unless more stringent requirements are indicated. Anchor equipment securely, positioned at locations and elevations indicated.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" and ACI 301 (/ACI 301M) for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Perform visual inspections and operational tests as recommended by referenced standard rules of each sport and the equipment manufacturer.
2. Test rebound elasticity of basketball goals.
3. Test basketball goal pressure-release characteristics and adjustability.

C. Equipment items will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 122413 - ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, single-roller shades.
2. Motor-operated, single-roller shades.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 3 inches square. Mark interior face of material if applicable.

E. Product Schedule: For roller shades.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Draper, Inc.
2. Legrand Shading Systems; Legrand North America, LLC.
3. Lutron Electronics Co., Inc.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Draper, Inc.
2. Legrand Shading Systems; Legrand North America, LLC.
3. Lutron Electronics Co., Inc.

B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

    a. Electrical Characteristics: 110-V ac.
    b. Maximum Total Shade Width: As required to operate roller shades indicated.
    c. Maximum Shade Drop: As required to operate roller shades indicated.
    d. Maximum Weight Capacity: As required to operate roller shades indicated.

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:

    a. Keyed Control Station: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
    b. Color: As selected by Architect from manufacturer's full range.

4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: PVC-coated fiberglass.
3. Weave: Basketweave.
4. Orientation on Shadeband: Up the bolt.
5. Openness Factor: 5 percent.
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:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, 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 to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations:

1. At all exterior windows; Manual roller shades at windows with a head height of 10 foot or below, Motorized roller shades at windows with a sill height 10 foot and above.
2. At interior windows and sidelites; only when indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Plans, sections, details, edge and backsplash profiles, and attachments to other work.
2. Locations and details of joints.
3. Locations and sizes of cutouts and holes for items installed in countertop.

C. Samples for Verification:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.
2. Wood-Grain Plastic Laminates: For each type, color, pattern, and surface finish required, 12 by 24 inches in size.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate locations and sizes of cutouts and holes for items installed in countertop and backsplashes.

B. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.

C. Quality Standard Compliance Certificates: AWI's Quality Certification Program.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: Fabricator of products or AWI's Quality Certification Program accredited participant.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.6 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Plastic-Laminate-Clad Countertop; Product offerings that may be incorporated into the Work include, but are not limited to the following:

1. Wilsonart.
2. Formica.
3. Or Architect Approved Equal.

B. Quality Standard: Unless otherwise indicated, comply with ANSI/AWI 1236 for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grade specified.

C. Grade: Custom.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by Architect's designation in drawings.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard or MDF.

G. Core Material at Sinks: Particleboard or MDF made with exterior glue.

H. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

I. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Panel Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2.

a. Grade 130 or better; complying with performance requirements specified.

2. Particleboard: ANSI A208.1.

a. Grade M-2 or better; complying with performance requirements specified.

2.3 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

B. Installation Adhesive: Manufacturer's standard product that is recommended for application indicated.

2.4 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to extent that it was not completed in the shop.

1. Provide cutouts for 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. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where indicated on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

E. Countertop Installation:

1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
4. Install countertops level and true in line. Use concealed shims as required to maintain not more than 1/8-inch-in-96-inch variation from a straight, level plane.
5. Secure backsplashes to walls with adhesive.
6. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the referenced standard for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.5 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where impossible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semi exposed surfaces.

C. Protection: Provide kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material sinks.
5. Solid surface material window stools.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 3 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

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. Formica Corporation.
b. LG Hausys, Ltd.
c. Wilsonart LLC.
d. DuPont; Corian.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
4. Colors and Patterns: As indicated in architectural drawings.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

D. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM-D 6007 or ASTM-E 1333:

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.
3. MDF More Than 5/16 Inch Thick: 0.11 ppm.
4. MDF 5/16 Inch or Less in Thickness: 0.13 ppm.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top and bottom.
2. Backsplash: Integral Straight, slightly eased at corner.

C. Window Stools: Fabricate window stools equal to the width of the window opening an depth allowing a 1/2-inch overhang.

1. ½-inch-thick, solid surface material, color and patterns as indicated in drawings.

D. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up to 1-1/2-inch thick-with same material. Color and patterns as indicated in drawings.

E. Backsplashes: 1/2-inch- thick, solid surface material.

F. Fabricate tops 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 in the shop.

G. Joints:

1. Fabricate countertops without joints when feasible.
2. When joints are required, fabricate countertops in sections for joining in field.

a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

H. Cutouts and Holes:

1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. 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.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Window Stool Installation:

1. Scribe and cut window stools to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

2. Install window stools level to a tolerance of 1/8-inch maximum.
3. Secure window stools with adhesive according to manufacturer's written instructions.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

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SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.
4. Quartz agglomerate apron fronts.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Verification: For the following products:

1. Countertop material, 3 inches square.
2. Wood trim, 8 inches long.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as indicated on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.

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. Cambria.
b. LG Hausys, Ltd.
c. Wilsonart LLC.

2. Colors and Patterns: As indicated on Architectural drawings.

B. Solid Wood Edges and Trim: Clear red oak lumber, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.

C. Composite Wood Products: Products shall be made without urea formaldehyde.

D. Particleboard: ANSI A208.1, Grade M-2.

E. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top and bottom.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 3/4-inch thick, quartz agglomerate with front edge built up with same material.

D. Backsplashes: 3/4-inch thick, quartz agglomerate.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints:

1. Fabricate countertops without joints when feasible.
2. Fabricate countertops in sections for joining in field when required.

a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
b. Joint Type, Bonded: 1/32 inch or less in width.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

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SECTION 126613 - TELESCOPING SEATING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Multiple-tiered telescopic gym seating.

B. Related Sections:

1. Section 116643 “Interior Scoreboards” for communication and power passthrough requirements for scorekeeper controller attachments.
2. Division 26 Electrical sections for electrical wiring and connections for electrically operated telescoping stands.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of components, and finishes for seating.

B. Shop Drawings: For telescoping stands in both stacked and extended positions. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, row-lettering scheme, anchorage to supporting structure, material types and finishes.

1. Electrical: Indicate power supply requirements.

C. Samples for Initial Selection: For each type of exposed material, color, finish, and texture indicated.

1. Include Samples of accessories involving color and finish selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Certificates: For each type of bench seating.

1. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For telescopic bleacher to include video operations manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Individual Seat Pads: 5 percent of quantity installed for each color.
2. Row-Letter Plates: 10, blank.
3. Seat-Number Plates: 25, blank.
4. Donor Plates: 25, blank.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver telescoping stands in manufacturers packaging clearly labeled with manufacturer name and content.

B. Handle bleacher equipment in a manner to prevent damage.

C. Deliver the telescoping stands at a scheduled time for installation that will not interfere with other trades operating in the building when at all possible.

1.8 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.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of bench seating that fail in materials or workmanship within specified warranty period including cost of materials, labor, and freight.

1. Failures include, but are not limited to, the following:

a. Structural failures including bench seating and attached components.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Periods: 10 years from date of Substantial Completion for structural and understructure components; 5 years from date of Substantial Completion for decking, seating, enclosure curtains, and surface material finishes.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of bench seating required, including accessories and mounting components, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Bench seating shall withstand the effects of gravity and other loads within limits and under conditions indicated.

B. Gymnasium seat assembly: Design to support and resist, in addition to its own weight, the following forces:

1. Live load of 120 lbs. per linear foot (1.75 kN/m) on seats and decking.
2. Uniformly distributed live load of not less than 100 psf (4.79 kN/m2) of gross horizontal projection.
3. Parallel sway load of 24 lbs. per linear foot (0.35 kN/m) of row combined with (b.) above.
4. Perpendicular sway load of 10 lbs. per linear foot (0.15 kN/m) of row combined with uniformly distributed live load above.
5. Parallel and Perpendicular sway loads are not applied concurrently.

C. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:

1. Concentrated load of 200 lbs. (0.89 kN) applied at any point and in any direction.
2. Uniform load of 50 lbs. per foot (0.73 kN/m) applied in any direction.

D. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:

1. Concentrated load of 200 lbs. (0.89 kN) applied at any point and in any direction along top rail.
2. Uniform load of 50 lbs. per foot (0.73 kN/m) applied in any direction at top rail.
3. Uniform load of 50 lbs. (0.22 kN) applied on an area equal to 1 ft2 (0.09 m2) applied on all guardrail infill panels.

2.3 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.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hussey Seating Company; MAXAM or comparable product by one of the following:

a. Architect approved equal.

2. Dimensions:

    a. Aisle Width: See drawings.
    b. Number of Tiers: See drawings.
    c. Row Spacing: 24 inches (610 mm).
    d. Row Rise: 11-5/8 inches (295 mm).

3. Operation: Integral Power.

    a. Controls: Keyed wall switch.
    b. Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.
    c. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB, activates when stands are in motion.

2.4 SEATING

A. Polymer Seat System: Individual replaceable contoured seating.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hussey Seating Company; XC12 or comparable product by one of the following:

    a. Architect approved equal.

2. Material: Gas assist injection-molded, 100 percent recyclable HDPE, high density polyethylene.
3. Module Size: 18 inches (457 mm) long by 12 inches (305 mm) deep.
4. Module Load: Tested to 600 lbs. (2.67 kN).
5. Seat height: 18-1/8 inches (410 mm) from deck to top of seat.
6. Integrally molded end caps at aisle end locations.
7. Integrally molded recess pockets to accept seat number and row letters.
8. 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.
9. Color: As selected by Architect from manufacturer's standard colors.

2.5 ADA ACCESSIBLE SEATING:

A. Modular Retractable Tiers: 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 retractable unit shall have a handle for easy operation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hussey Seating Company; FLEX-ROW or comparable product by one of the following:

    a. Architect approved equal.

2. Locate first tier modular units to provide wheelchair-accessible seating at locations indicated on Drawings.
3. Provide a black full-surround steel skirting with no more than ¾" floor clearance for safety and improved aesthetics.

4. Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.
5. Provide a mechanical positive lock when the system is in both the open and closed position. Handle shall unlock the modular recoverable seating unit for operation and be able to be utilized with the full system in the open or closed position.
6. Provide signage to mark the location of each module to assist with seating identification.

2.6 RAILS, PANELS AND STEPS

A. End Rails: Self-storing.

1. Provide steel self-storing starting no higher than 42 inches (1066mm) high above seat, end rail with tubular supports and intermediate members designed with 4 inch (102mm) sphere passage requirements.
2. Material and Finish: Semi-gloss powder coated steel.
3. Color: As selected by Architect from manufacturer's standard colors.

B. Center Aisle Rails: Removable/Store in Place.

1. Provide single pedestal mount handrails starting no higher than 34 inches (864mm) high with terminating mid rail. Handrails shall be lifted, rotated 90 degrees and reinserted for easy storage in socket. Ends of the handrail shall return to the post, and not extend away from it. Rails having openings to avoid interference with closed decks are not acceptable.
2. Material and Finish: Semi-gloss powder coated steel.
3. Color: As selected by Architect from manufacturer's standard colors.

C. Steps: Flip-up Front Aisle Step:

1. Provide permanently hinged to the front row to ensure availability and ease of operation. Two 3" diameter x ¾" wide non-marking front wheels are provided so that the system can be operated with the Sure-Step in the stored or deployed position. All edges coined, hemmed or radiused with front edge protective rubber bumpers. Abrasive-backed non-slip tread identifier on leading edge of nosing. For aisle widths greater than 6'-0", two side by side hinged steps are provided.

2.7 ACCESSORIES

A. Identification Plates: Provide manufacturer's standard identification plates for the following:

1. Row-Number Plates.
2. Seat-Number Plates.
3. Donor Plates.

B. Scorer's Table: Removable unit with a gray textured top of molded 2 inch (51 mm) thick polymer with eased edges and integral 16 gage (1.51 mm) cantilevered comfort C-style leg.

1. Size: 8 feet (2438 mm) by 18 inches (457 mm) by 30 inches (762 mm).

C. Safety End-Closure Curtains: Provide curtains for preventing unauthorized access to underside of bleachers while in the open position.

2.8 MATERIALS

A. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

C. Steel: Hot-dip galvanized after fabrication.

D. Molded Plastic: High-density plastic, blow or injection molded, with surface that is mar and dent resistant.

1. Color and Texture: As selected by Architect from manufacturer's full range.
2. Provide with UV inhibitors to retard fading.

E. Fasteners: Aluminum, hot-dip galvanized steel, or stainless steel. Use fasteners of the same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each metal joined.

1. Use concealed fasteners for interconnecting metal components and for attaching them to other work unless exposed fasteners are unavoidable.
2. For exposed fasteners, use tamper-resistant screws of head profile flush with metal surface unless otherwise indicated.
3. Finish heads of exposed fasteners to match finish of metal fastened unless otherwise indicated.
4. Do not use power-actuated fasteners for concrete substrates.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M10C22A31, Class II, 0.010 mm or thicker.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.11 FABRICATION

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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine floors, risers, and other adjacent work and conditions, 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. Tolerances:

1. Flooring: 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/m2).

B. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust so that operation of telescoping and retracting functions without interference, binding, rubbing, or otherwise causing premature wear to the assembly and surrounding finishes.

B. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

C. Replace damaged and malfunctioning components that cannot be acceptably repaired.

END OF SECTION

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SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes pipe, fittings, valves, and connections for the extension of the existing sprinkler system serving the Graceville School.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for piping painting specified by this section.
2. Section 230500 - Basic Fire Protection, Plumbing and HVAC requirements.
3. Section 230529 - Hangers, Supports and Firestopping for Plumbing, Fire Protection, HVAC Piping and Equipment.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.25 - Buttwelding Ends.
6. ASME B16.3 - Malleable Iron Threaded Fittings.
7. ASME B16.4 - Gray Iron Threaded Fittings.
8. ASME B16.5 - Pipe Flanges and Flanged Fittings.
9. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
5. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
6. ASTM B32 - Standard Specification for Solder Metal.
7. ASTM B75 - Standard Specification for Seamless Copper Tube.
8. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
9. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:

1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. National Fire Protection Association:

1. NFPA 13 - Installation of Sprinkler Systems.
2. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

F. Underwriter Laboratories, Inc.:

1. UL 1887 - Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

1.3 1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Product Data: Submit manufacturer’s catalogue information. Indicate valve data and ratings.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and tag numbering.

C. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13 and State of Minnesota standards.

B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Furnish cast iron and steel valves with temporary protective coating.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.7 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bond.

B. The Contractor shall be responsible for the proper installation and working of everything in their portion of the project and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from the date of Substantial Completion of the work (unless noted otherwise as a longer warranty period in an individual specification section). Refer to Division 01 for more details.

PART 2 PRODUCTS

2.1 VALVES

A. Gate Valve Manufacturers: (3" and Above).

1. Stockham.
2. Nibco.
3. Kennedy.
4. American Valve.
5. Crane.
6. Milwaukee.

B. Gate Valves:

1. 3" and Over: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

C. Globe Valve Manufacturers:

1. Keystone.
2. Ohio Brass.
3. Stockham.

D. Globe Valves:

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity packable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

E. Ball Valve Manufacturers: 2-Piece.

1. Jamesbury - 2000.
2. Apollo - #77/80/82.
3. Worcester.
4. Watts - B-6080.
5. Nibco - T-585-70.
6. American - 2A.
7. Milwaukee - BA475B.
8. Hammond - 8901.

F. Ball Valves:

1. Up to and including 3 inches: Bronze two piece body, or stainless steel ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends with union.

G. Butterfly Valve Manufacturers:

1. Victaulic.
2. Kennedy.
3. Nibco.
4. Central.
5. Watchman.
6. Mueller.
7. Shurjoint.
8. Milwaukee Butterball.
9. Anvil Gruvlock.

H. Butterfly Valves: (3" and Above).

1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved.
2. ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch.
3. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile.
4. iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device, external tamper switch.

I. Check Valve Manufacturers:

1. Stockham.
2. Nibco.
3. Kennedy.

4. Mueller.
5. Keystone.
6. Ames.
7. Shurjoint.

J. Check Valves:

1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
2. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.
4. Over 2" Riser Check: Iron body, grooved end, single clapper, and dual springs for non-slamming operation.

K. Drain Valve Manufacturers:

1. Apollo.
2. Stockham.
3. Ohio Brass.
4. Milwaukee - BA100H.

L. Drain Valves:

1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53/A53M, Grade B; ASTM A135; ASTM A795; ASME B36.10; black; weight specified in NFPA 13.

2.3 UNIONS, FLANGES AND COUPLINGS

A. Manufacturers:

1. Victaulic.
2. Anvil/Gruvlok.

B. Unions, Flanges and Couplings:

1. Unions: 150 psi malleable iron for threaded ferrous piping.
2. Flanges: 150 psi forged steel slip on flanges for ferrous piping.
3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; "C" shaped composition sealing gasket, steel bolts, nuts and washers; galvanized couplings for galvanized pipe.

PART 3 EXECUTION

3.1 PREPARATION

A. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install piping in accordance with NFPA 13 for sprinkler systems, and NFPA 24 for service mains.

B. Install Work in accordance with State of MN standards.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation. Caulk & Seal all openings located above finished ceilings. Caulk, Seal and provide split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Division 09.

J. Do not penetrate building structural members unless indicated.

K. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

L. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

N. Install gate or butterfly valves for shut-off or isolating service.

O. Install drain valves at main shut-off valves, low points of piping and apparatus.

P. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut above slab.

3.3 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean entire system after other construction is complete.

END OF SECTION

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SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

B. Related Sections:

1. Section 230500 - Basic Fire Protection, Plumbing, and HVAC requirements.
2. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

A. Fire protection system to provide coverage for the entire building utilizing three sprinkler zones. Existing Zone # 1 shall remain to cover the entire existing Area 'B'. Existing Zone # 2 shall remain and be extended to serve the Pre-K addition in Area 'A'. New Zone # 3 shall be provided to cover the Area 'C' building addition. Zone boundaries and total square footage are shown on drawings F1.1 thru F1.3.

B. Remove existing single check valve backflow preventer. Install new double check valve backflow preventer on existing fire protection service line.

C. Provide hydraulically designed system to NFPA 13 light & ordinary group 1 hazards occupancy requirements. Storage Rooms, Mechanical Rooms, Electrical Rooms shall be designed Ordinary Hazard Group 1 occupancy.

D. Determine volume and pressure of incoming water supply from water flow test data.

E. Interface system with building fire and smoke alarm system.

F. The automatic fire extinguishing system must be installed as per IBC chapter 9 as amended.

G. Maintain existing fire department connection as indicated on Drawings.

H. All sprinkler piping shall be concealed above suspended ceilings.

I. Sprinkler contractor shall replace any ceiling tile damaged during piping installation and system testing.

J. Provide sprinkler coverage under all equipment or areas with 34" or more space underneath them.

K. Provide heavy duty type wire guards on heads in all recreational areas such as Gymnasiums, etc.

L. Provide quick response heads in all light hazard areas.

M. Areas subject to freezing conditions shall be provided with a non-freeze system that meets ANSI/NFPA standards and all state and local codes. All areas requiring more than (2) sprinklers shall be designed with complete dry pipe sprinkler systems.

N. Sprinkler Contractor shall furnish and install all required air maintenance equipment and valves as necessary for a successful installation.

O. Where sprinkler piping is installed in spaces with exposed structures, piping shall be run parallel with lighting.

P. Provide sprinkler coverage under all ductwork 48" or larger in width.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Design Data: Submit hydraulic design calculations and detailed pipe layout. Submittals must be signed and sealed by Engineer or NICET level 4 certified individual.

E. Submit all shops with Contractors stamp of approval with signature for approval by;

1. Local Building Inspector and Fire Chief,
2. Owner's insurance,
3. State Fire Marshall,
4. State Building Codes Department and,
5. Architect/ Engineer in this order.

F. Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13 and State of Minnesota Standards.

B. Maintain one copy of each document on site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish piping with temporary inlet and outlet caps until installation.

1.8 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. The Contractor shall be responsible for the proper installation and working of everything in their portion of the project and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from the date of Substantial Completion of the work (unless noted otherwise as a longer warranty period in an individual specification section). Refer to Division 01 for more details.

1.9 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Furnish metal storage cabinet.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Manufacturers:

1. Grinnell Corp.
2. Reliable Sprinkler Corp.
3. Viking Corp.
4. Star.
5. Central.
6. TYCO.

B. Furnish materials in accordance with State of Minnesota standards.

C. Suspended Ceiling Type:

1. Type: Concealed pendant type with matching escutcheon plate.
2. Finish: Brass.
3. Escutcheon Plate Finish: Enamel, color matching ceiling tiles.
4. Fusible Link: temperature rated for specific area hazard.

D. Gypsum Ceiling Type:

1. Type: Concealed pendant type with matching escutcheon plate.
2. Finish: Brass.
3. Escutcheon Plate Finish: Enamel, color matching ceiling.
4. Fusible Link: temperature rated for specific area hazard.

E. Exposed Area Type:

1. Type: Standard upright type.
2. Finish: Brass.
3. Fusible Link: temperature rated for specific area hazard.
4. Guards: Furnish guards in all recreational areas such as the Fieldhouse. Color match to adjacent ceilings.

F. Side wall Type:

1. Type: Semi-recessed horizontal side wall type with matching escutcheon plate.
2. Finish: Chrome plated.
3. Escutcheon Plate Finish: Chrome plated.
4. Fusible Link: temperature rated for specific area hazard.

G. Guards: Finish to match sprinkler finish.

2.2 PIPING SPECIALTIES

A. Automatic Sprinkler Valve: Flow detector with alarm circuits, pressure switch, pressure retard chamber.

B. Sprinkler Contractor shall conduct an actual flow test at job site prior to sprinkler design to determine exact water supply available.

C. Furnish and install all zone valves, tamper switches, flow switches and drains as shown on sprinkler plans. Pipe inspector's test connection to nearest floor drain.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13.

B. Install Work in accordance with State of MN standards.

C. Install a new approved double check valve assembly at sprinkler system water source connection.

D. Place pipe runs to minimize obstruction to other work.

E. Install piping in concealed spaces above finished ceilings.

F. Provide heavy duty type wire guards on heads in all recreational areas such as the Gymnasium, etc.

G. Hydrostatically test entire system.

H. Required test shall be witnessed by Fire Marshall.

I. Sprinkler heads shall be symmetrical in room and shall be 6” or greater from any grid.

J. If the Inspectors Test & Drain does not discharge over a hard surface, provide splash block under discharge of drain.

3.2 DESIGN COORDINATION

A. The layout of fire protection sprinkler piping shall take into account any and all conflicts that may exist between structural conditions, ductwork layouts and other piping in the ceiling space.

B. The locations and depths of all lighting fixtures shall be verified prior to attempting a fire protection sprinkler piping layout.

C. Any necessary field installation piping revisions necessary to avoid conflicts between the fire protection/sprinkler piping and any or all of the items listed above shall be done at no additional cost to the owner.

D. Sprinkler Contractor to provide all necessary regular and/or fire rated access doors for any required access in finished spaces. Refer to Division 08, Specification Section 080000.

E. Mechanical and electrical drawings will be made available to the fire protection sprinkler contractor via e-mail in AutoCad Format.

3.3 PAINTING

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. All piping exposed in finished areas, except for piping in mechanical and storage room, shall be painted in a color to match the adjacent surfaces by Painting Contractor.

C. Fire Protection Contractor shall prepare surfaces for painting by removing rust scale and dirt from surfaces to be painted.

D. Fire Protection Contractor shall apply strippable tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish. Also protect all exposed heads from receiving field paint. Replace any painted sprinklers heads with new heads.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace any painted sprinklers with new.

3.7 SIGNAGE

A. This Contractor shall provide at a minimum 11x17 framed or laminated overall building print. Print shall show zone numbers, separations and area served for each zone. Secure to wall near existing fire riser assembly.

END OF SECTION

SECTION 221100 - FACILITY WATER DISTRIBUTION AND SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water piping, above grade.
2. Domestic water piping, below grade inside building perimeter.
3. Unions and flanges.
4. Valves.
5. Pressure gauges.
6. Pressure gauge taps.
7. Thermometers.
8. Recirculation control valves.
9. Water Meter.
10. Hose bibbs.
11. Wall Hydrants.
12. Water hammer arrestors.
13. In-line circulator pumps.
14. Hot water expansion tank.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
4. Section 230516 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
5. Section 230500 - Basic Fire Protection, Plumbing and HVAC Requirements.
6. Section 230529 - Hangers and Supports and Firestopping for HVAC Piping, Plumbing Piping and Equipment.
7. Section 230553 - Identification for HVAC Piping, Plumbing Piping, and Equipment.
8. Section 230700 - HVAC and Plumbing Insulation.
9. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
10. Division 33 - Disinfecting of Water Utility Distribution: Product and execution requirements for disinfection of domestic water piping beyond 5 feet of building.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI/NSF Standard 61-G.

B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.

C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
9. ASTM F876 - Standard Specification for Cross Linked Polyethylene (PEX) Tubing.
10. ASTM F877 - Standard Specification for Cross Linked Polyethylene (PEX) plastic hot and cold water distribution systems.
11. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
12. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
13. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
6. AWWA C651 - Disinfecting Water Mains.
7. AWWA C702 - Cold-Water Meters - Compound Type.
8. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
9. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
4. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

D. Maintain one copy of each document on site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain it in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. The Contractor shall be responsible for the proper installation and working of everything in their portion of the project and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from the date of Substantial Completion of the work (unless noted otherwise as a longer warranty period in an individual specification section). Refer to Division 01 for more details.

1.9 LEAD FREE REQUIREMENTS

A. All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings, valves and fixtures in potable water systems that have a weighted average lead content ≤0.25% per the Federal Safe Drinking Water Act.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN BUILDING.

A. Copper Tubing: ASTM B88, Type K, annealed.

1. Fittings: ASME B16.22, wrought copper.
2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. After Water Meter: Pex Tubing: ASTM F876 and F877, single layer, cross linked polyethylene extrusion with an outer layer composed of an Evoh oxygen barrier. AquaPex, manufactured by Uponor. REHAU & Heatlink are approved equals.

2.2 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L hard drawn. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA or grooved mechanical couplings and fittings for 2"-6".

B. 2” and smaller Pex Tubing: ASTM F876 and F877, single layer, cross linked polyethylene extrusion with an outer layer composed of an Evoh oxygen barrier. AquaPex, manufactured by Uponor. Refer to Section 23 0700 for insulation. Refer to 23 0529 for Pex-a support requirements. REHAU & Heatlink are approved equals.

2.3 COPPER PRESS FITTINGS AND BALL VALVES

A. Viega Pro-Press type fittings shall be as manufactured by Rigid Tool Company.

B. Press fittings: copper Pro-Press type fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. The fittings shall be acceptable for domestic water usage.

C. Ball valves with Press Connections where Copper Press piping systems are allowed shall be Lead Free, Brass Body in accordance with ASTM B283 Alloy C37700, fully annealed. Ball shall be Chrome-Plated Brass in Full Port design with a smooth cylindrical port in ball (no hollow balls allowed). Valve must mate with standard Copper Tubing (K or L) conforming to ASTM B88, assembled by tooling recommended by the Copper Press Fitting manufacturer. The Ball Valve must have factory installed O-rings furnished in EPDM material of type and size compliant with the Copper Press Fittings. The ball valve must be certified to NSF 61 and MSS SP110 in all applicable areas.

D. Quality Standard: Milwaukee UltraPure Model UPBA-480B, UPBA-490B or approved equal.

2.4 GROOVED FITTINGS AND COUPLINGS (FOR COPPER PIPE SIZES 2" AND ABOVE.)

A. Copper Grooved-End Fittings: ASTM B75 copper tube or ASTM B152 wrought copper or ASTM B584 cast bronze fittings with copper tubing sized grooved ends designed to accept grooved couplings (flaring of tube and fitting ends to IPS dimensions is not permitted).

B. Grooved-End Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections cast with offsetting, angle-pattern bolt pads, coated with copper-colored enamel, EHP-synthetic rubber suitable for operating temperatures to +250°F and bolts and nuts. Installation-ready, for direct stab installation without field disassembly. Victaulic Style 607, or Anvil Gruvlok CTS 6400.

C. Grooved-End Tube Flange Adapters: Copper-tube dimensions and design similar to AWWA C606. Ductile-iron casting, coated with copper-colored enamel, flat-faced, for engaging into roll grooved copper tube and fittings and bolting directly to flanges with ANSI Class 125 and 150 bolt hole patterns. Victaulic Style 641, Gruvlok CTS 6084.

D. Grooved-End Tube Mechanical-T®: Copper-tube dimensions and design similar to AWWA C606. Bronze upper housing and copper-colored enamel coated ductile iron lower housing, threaded outlet and locating collar, EPDM synthetic rubber gasket suitable for hot and cold water and bolts and nuts. Victaulic Style 622.

2.5 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; "C" shape composition sealing gasket, steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.

2.6 GATE VALVES

A. Manufacturers:

1. Crane - 465-1/2.
2. Hammond - IR1140.
3. Milwaukee - F2885-M.
4. NIBCO - F-617-0.
5. American - 3FG.

B. Over 3 Inches: Cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged or grooved ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.7 GLOBE VALVES

A. Manufacturers:

1. 2-1/2" & Under 3" & Larger.
2. Crane 1310 351.
3. Hammond IB-440/418 IR-116.
4. Milwaukee Valve Co. 1502/502 F2981M.
5. NIBCO, Inc. T/S 211F718-B.
6. American IOU ----.

B. Up to 2-1/2 inches: Bronze body, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with backseating capacity.

C. Over 2-1/2 inches: Iron body, bronze trim, rising stem and handwheel, OS&Y, plug-type disc, flanged ends.

2.8 BALL VALVES - FULL PORT TYPE

A. 3” and smaller: Two piece bronze body; sweat or threaded ends, chrome plated bronze ball; glass filled Teflon seat; Teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Apollo 70LF-200, Hammond UP8511, Milwaukee UPBA150, Nibco S580-80-LF, Watts LFB-6081G2.

2.9 BUTTERFLY VALVES

A. Manufacturers:

1. Milwaukee - M or C series.
2. Hammond - 5200 or 6200 series.
3. Nibco - LD2000/LC2860.
4. Victaulic - 608.
5. Watts - BF-03-M2.

B. Butterfly Valves 2-1/2” and Larger.

1. Cast or ductile iron body; stainless steel shaft; bronze, copper or teflon bushings; EPDM resilient seat; EPDM seals; bronze, aluminum-bronze, EPDM encapsulated ductile iron or stainless steel disc.200 psig WOG up to 12”. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws or grooved end connection valves, permitting removal of downstream piping while using the valve for system shut-off.

2.10 SWING CHECK VALVES

A. 3” and smaller: Bronze body, sweat or threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Hammond UP904, Milwaukiee UP509, Nibco S413-Y-LF, Watts LFCV, Apollo equal.

2.11 SPRING LOADED CHECK VALVES

A. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. Milwaukee UP-548, Conbraco 61 series, Nibco S480-Y-LF, Watts LF600 or equal.

B. 2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. Hammond IR9253 or IR9354, Milwaukee 1400 or 1800 series, Nibco W910-LF or F910-LF.

2.12 PRESSURE GAUGES

A. Manufacturers:H.O. Trerice Model 800B.

1. Substitutions: Approved equal prior to bid.

B. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Steel, black finished, stem-mounted-flangeless.
2. Bourdon Tube: Brass.
3. Dial Size: 2 inch diameter.
4. Mid-Scale Accuracy: +/- 1.6 percent.
5. Scale: Psi.

2.13 PRESSURE GAUGE TAPS

A. Manufacturers:

1. H.O. Trerice Model 872.
2. Substitutions: Approved equal prior to bid.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

C. Ball Valve: Brass, 1/4 inch NPT for 250 psi.

D. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

2.14 STEM TYPE THERMOMETERS

A. Manufacturers:

1. H.O. Trerice Model BX9.
2. Substitutions: Approved equal prior to bid.

B. Thermometer: ASTM E1, blue liquid filled, lens front tube, cast aluminum case with enamel finish.

1. Size: 9 inch scale.
2. Window: Acrylic.

3. Stem: Aluminum, 3-1/2 inch long, w/ adjustable angle.
4. Accuracy: 0.6% of temperature.
5. Calibration: Degrees F.

2.15 RECIRCULATION CONTROL VALVES

A. Manufacturers:

1. Therm-Omega-Tech - Model Circuit Solver.

B. Furnish and install as indicated on the Plans, Circuit Solver in the domestic hot water piping. Circuit Solver shall be self-contained and fully automatic without additional piping or control mechanisms. Valve shall be a Circuit Solver as manufactured by Therm-Omega-Tech, Inc., or equivalent.

1. Circuit Solver shall regulate the flow of re-circulated domestic hot water based on water temperature entering Circuit Solver regardless of system operating pressure.

a. When fully closed, Circuit Solver shall bypass a minimum flow to maintain dynamic control of the re-circulating loop and provide a means for system sanitizing.
b. Circuit Solver shall be factory-adjustable from 105F to 140F as required by project conditions. (Other setpoints are available, consult factory.).

1) Circuit Solver shall modulate between open and closed position within a 10F range.

c. Circuit Solver shall be available in sizes ranging from 1/2 inch NPT to 2" NPT.

C. Circuit Solver body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless steel.

1. Circuit Solver sizes 1/2 inch through 2 inch shall be rated to 200 PSIG maximum working pressure.

a. All Circuit Solvers shall be standard tapered female pipe thread, NPT.

2. All Circuit Solvers shall be rated to 250F maximum working temperature.
3. Circuit Solver shall be ANSI/AWWA C800 compliant.
4. All Circuit Solvers shall be NSF-61 compliant with zero lead content for use in all domestic water systems.
5. Thermal actuator shall be spring-operated and self-cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits.

a. Thermal actuator shall be rated for a minimum of 200,000 cycles.

2.16 HOSE BIBBS - HB-1

A. Manufacturers:

1. Woodford.

2. Zurn.
3. Josam.
4. Ancon.
5. Mifab.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Woodford model V26, backflow protected wall faucet.

1. Body Material: Cast brass.
2. Seat: Bronze, replaceable.
3. Supply Connections: NPS 3/4 threaded top mount inlet.
4. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
5. Pressure Rating: 125 psig.
6. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1052.
7. Finish: Rough Brass.
8. Operation: Metal Handle.

2.17 FREEZE PROOF WALL HYDRANT - FPWH-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Woodford Manufacturing Company Model RB67 Round-Box type or an approved equal by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.;
3. Watts Drainage Products Inc.
4. Zurn Plumbing Products Group.

B. Standard: ASME A112.21.3M, automatic draining with double check valve backflow preventer wall hydrants. ASSE Standard 1052 for inlet and outlets.

1. Pressure Rating: 125 psig.
2. Operation: Loose key.
3. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
4. Inlet: NPS 3/4.
5. Outlet: Round Box Model RB67, with vacuum breaker and garden-hose thread complying with ASME B1.20.7.
6. Exterior Finish: Chrome.
7. Size: Model RB67 fits thru standard 6” core drilled hole.
8. Operating Keys(s): One with each wall hydrant.

2.18 POSITIVE DISPLACEMENT METERS (LIQUID)

A. Water Meter shall be furnished by the city of Graceville. Plumbing Contractor shall install per the city requirements.

2.19 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Zurn - Basis of Design.
2. Precision Plumbing Products.

B. Stainless steel pre-charged suitable for operation in temperature range of 34 to 300 degrees F and a maximum 125 psi working pressure.

2.20 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. B & G.
2. Grundfos.
3. TACO.

B. Casing: Lead Free Bronze rated for 150 psig working pressure.

C. Impeller: Noryl.

D. Shaft: Ceramic.

E. Bearings: Carbon.

F. Drive: Flexible coupling.

G. Basis of design: B&G NBF Series (see schedule on drawings).

2.21 ACCEPTABLE MANUFACTURERS - EXPANSION TANK (DOMESTIC HW)

A. Amtrol.

B. ITT - Bell Gossett.

C. Elbi.

D. Or Approved Equal prior to bidding.

2.22 EXPANSION TANK

A. Furnish and install as shown on plans a 16-1/2 gallon, 15“ diameter x 25“ high pre-charged hydropneumatic steel expansion tank. The tank construction shall be in accordance with Section VIII of ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature of 200 degrees F. All internal wetted parts must comply with

FDA regulations and approvals. An internal butyl diaphragm will be used to isolate air charge from water.

B. Each tank shall be AMTROL Therm-X-Trol Model No. ST-30VC-DD or approved equal prior to bidding.

PART 3 EXECUTION

3.1 SERVICE CONNECTIONS

A. New water shall be provided to a flange above the floor by the Plumbing Contractor. Plumbing contractor shall be responsible for domestic tee. Install water meter and valves as required by the city of Graceville Public Works Department.

3.2 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

3.4 INSTALLATION - METERS

A. Install positive displacement meters in accordance with AWWA M6, with full port isolating valves on inlet and outlet.

3.5 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 0700.

H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

L. Install domestic water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 23 0529.

N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 23 0529.

O. Install unions downstream of valves and at equipment or apparatus connections.

P. Install valves with stems upright or horizontal, not inverted.

Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

R. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

S. Install globe valves for throttling, bypass, or manual flow control services.

T. Provide spring loaded check valves on discharge of water pumps.

U. Provide flow controls in water circulating systems as indicated on Drawing and specified in this section.

V. Remove scale and dirt on inside of piping before assembly.

W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; janitor rooms, fire sprinkler systems, irrigation systems, interior and exterior hose-bibbs/wall-hydrants.

X. Test backflow preventers in accordance with ASSE 5015.

Y. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping as shown.

Z. Solder and flux containing less than 0.2 percent lead shall be used. 95-5 tin-antimony or 96-4 tin-silver are approved solders.

AA. All plumbing shall be installed in accordance with the Minnesota Plumbing Code.

BB. All plumbing valves, fittings, or fixtures coming in contact with potable water used for drinking or cooking shall be lead-free. All products shall have a weighted average of less than 0.25 percent lead content per NSF/ANSI standard 61-G.

3.6 INSTALLATION, COPPER PRESS FIT FITTINGS

A. Press Connections: Copper Pro-Press type fittings shall be installed in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

3.7 INSTALLATION - CIRCULATING PUMPS

A. Provide flow fitting upstream of circulation pump to verify GPM flow.

B. Provide Thermostatic Recirculation Valve on circulating hot water branches as shown on floor plans. The most remote loop shall be installed with only a ball valve.

3.8 INSTALLATION - THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.9 RELIEF VALVES

A. Run T & P relief drain line from water heaters and terminate over floor drain.

3.10 EXCAVATION AND BACKFILLING

A. Underground Work (Inside the Buildings Outside Walls).

1. Mechanical Contractor to carry out all excavation, backfilling and compaction of earth required for the installation of underground lines within the buildings outside walls.
2. All backfill (on excavations inside of the building outside perimeter walls) shall be vibratory rolled or otherwise compacted to 95 percent of proctor density, tested at the rate of one test per 2500 sq. ft and re-packed and retested where the test results are under.
3. Mechanical Contractor shall note inverts of the sanitary runs inside and outside of the buildings and shall run lines to meet these inverts. Where these lines cross underground

footings or foundations the Mechanical Contractor shall provide oversize steel pipe sleeves before foundations are poured.

B. Refer to General Specification Division 01 for requirements of excavation and backfilling if different than the above. (The most stringent shall apply.).

3.11 TESTING REQUIREMENTS

A. As per Minnesota Rules Part 4714, no plumbing work may be covered prior to completing the required tests and inspections.

B. Mechanical Contractor shall verify that the State Department of Health has reviewed the Drawings for this Project prior to asking for an inspection of the underground piping.

C. Submit certification to Engineer showing that all necessary and required tests were performed for the entire Project including the following:

1. Water piping.

3.12 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Disinfect water distribution system in accordance with Division 33.

C. Prior to starting work, verify system is complete, flushed and clean.

D. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

E. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

F. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

G. Maintain disinfectant in system for 24 hours.

H. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

I. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

J. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

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SECTION 221126 - FACILITY LP GAS PIPING AND FUEL STORAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. LP gas piping buried.
2. LP gas piping above grade.
3. LP gas storage tanks.
4. LP gas vaporizer.
5. Unions and flanges.
6. Valves.
7. Pipe hangers and supports.
8. Strainers.
9. Underground pipe markers.
10. Bedding and cover materials.

B. Related Sections:

1. Section 230529 - Hangers and Supports for Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
2. Section 230553 - Identification for Piping and Equipment: Product requirements for valve and pipe identification for placement by this section.
3. Section 260503 - Equipment Wiring Systems.
4. Division 05 - Structural Steel Framing: Product requirements for touch-up painting of structural steel.
5. Division 05 - Steel Joist Framing: Product requirements for touch-up painting of steel joists.
6. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
7. Division 08 - Access Doors and Frames: Access doors for concealed valves and accessories.
8. Division 09 - Painting and Coating: Product requirements for painting for placement by this section.
9. Division 31 - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Division 31 - Excavation: Product and execution requirements for excavation and backfill required by this section.
11. Division 31 - Trenching: Execution requirements for trenching required by this section.
12. Division 31 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
4. ASME B31.9 - Building Services Piping.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. National Fire Protection Association:

1. NFPA 58 - Liquefied Petroleum Gas Code.

G. Underwriters Laboratories Inc.:

1. UL 842 - Valves for Flammable Fluids.

H. American Gas Association:

1. International Fuel Gas Code (IFC).

1.3 SYSTEM DESCRIPTION

A. System shall include (3) three new LP gas storage tanks, vaporizer and piping to new building addition.

B. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

C. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

D. Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 DEFINITIONS

A. Where designation LPG is used, it is abbreviation for Liquefied Petroleum Gas, most commonly Propane.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. LP Gas Tanks.

C. LP Gas Vaporizer.

D. LP Gas Valves and Tank Accessories.

E. Submit manufacturer's data and certifications on all piping, tubing, fittings, valves and tanks that are to be installed in the LP gas system complete. The submittal shall contain a complete, detailed schematic drawing of the tank installation and tank support details. Clearly identify all components (excess flow valves, control valves, pressure reducing valves, pipe sizes, etc.). Submit complete manufacturer's recommendations, requirements, procedures, temperatures, (welding) for the fusing welding of the polyethylene pipe, tubing, fittings and valves. Submit a copy of the installing company's current gas license and copies of individual installer's certificate that they have passed the manufacturer's qualification procedures for the welding and installation of polyethylene pipe, fittings and valves to be installed on this project.

F. Submittal of all gas system components, schematic drawings, manufacturer's data, fusing welding procedures, etc., shall be made at one time as a package. Partial submittals will not be accepted.

1.6 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance data under provisions of Division 01.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.7 QUALITY ASSURANCE

A. Perform LPG Work in accordance with NFPA 58 and IFC.

B. Perform work in accordance with applicable code and local gas company requirements.

C. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

D. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

E. Maintain one copy of each document on site.

F. Manufacturer's Qualifications - Firms regularly engaged in the manufacture of gas system products, of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

G. Installer's Qualifications - Firm with at least five years of successful installation experience on projects with gas systems work similar to that required for this project and licensed for gas installation in the state where the project is located. Provide certification that the individual installer(s) have been trained in and have passed the manufacturer's qualification procedures for the proper joining and installation of the polyethylene pipe, fittings and valves to be installed on this project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site.

B. Store and protect products as necessary to avoid any damage.

C. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for all equipment.

PART 2 PRODUCTS

2.1 LP GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASTM A234/A234M, forged steel welding type.
2. Joints: ASME B31.9, welded.
3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
4. Provide anode protection as required.

B. Polyethlene Pipe: ASTM D2513, SDR11.5 Fittings: ASTM D2683 or ASTM D2513 socket type. Joints: Fusion welded.

2.2 LP GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.4 BALL VALVES

A. Manufacturers:

1. Apollo - 70 or 80 Series.
2. Dezuric.
3. Milwaukee Valve Company - 8A475.
4. American - 2A.
5. Grinnell - 171N.
6. Jomar.
7. Substitutions: Division 01 - Product Requirements - Not Permitted.

B. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for LPG, full port.

C. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for LPG, conventional port.

D. Over 3" Inches: Cast iron body and plug, non-lubricated, teflon packing, flanged ends.

2.5 BUTTERFLY VALVES

A. Manufacturers:

1. Apollo.
2. Hammond Valve.
3. NIBCO, Inc.
4. Victaulic.
5. Grovlok.
6. Dezurik.
7. American.
8. Centerline.
9. Star SP Fittings.
10. Substitutions: Division 01 - Product Requirements.

B. 2 inches and Smaller: MSS SP 67, 175 psi, bronze body, Viton seals, stainless steel trim, lever handle UL 842 listed for gas service, full port.

2.6 EMERGENCY GAS VALVE ACTUATOR

A. Valve shall be Honeywell/Tradeline Model # V5055, refer to drawing for valve size.

B. Actuator shall be 120V, 1 phase, manual opening, electric holding with proof of closure switch. Model #V4055F manufactured by Honeywell/Tradeline.

1. Provide a valve and actuator for serving FACS Lab gas range.
2. Wiring and control shall be furnished and installed by Electrical Contractor.

2.7 STRAINERS

A. Manufacturers:

1. Mueller.
2. O.C. Keckley Company.
3. Spirax Sarco, Inc.
4. Substitutions: Division 01 - Product Requirements.

B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.8 UNDERGROUND PIPE MARKERS

A. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "LPG Service" in large letters.

2.9 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Division 31.

B. Cover: Fill Type as specified in Division 31.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Division 31. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.10 LP GAS BULK STORAGE TANK

A. 46" I.D. - 2,000 gallon capacity manufactured by Trinity Industries, Inc. of Dallas, Texas or approved equal. (3-thus).

B. Designed per latest ASME Pressure Vessel Code Section VIII, Div. 1.

C. Design Pressure - 250 psi at 120 deg. F.

D. Radiographic testing heads - spot, shell full.

E. Tank shall be roto-blasted on exterior, provided with one shop coat zinc chromate primer and a finish coat of industrial heavy duty rust resistant exterior paint - Bright White paint.

F. Accessories to include pressure gauges, thermometer, liquid level, relief valve, internal valves, back check valves, excess flow valves, emergency shutoff valves, ball valves and adapter fittings.

2.11 MANUFACTURER PACKAGED LP GAS VAPORIZER

A. ALGAS - SDI.

B. Ely, Inc.

C. Approved equal manufacturer prior to bidding.

2.12 LP GAS VAPORIZER

A. One required. Explosion proof. Meets Class 1, Division 1, Group D, specified in National Fire Protection Association Pamphlet 70. Vaporizing capacity 7.20 million BTU/HR. Torrexx Model # TX160, 208V, 3Ø as manufactured by ALGAS-SDI.

B. 98% thermal efficiency.

C. Standard automatic restart after power interruption.

D. Liqui-Safe valve that positively prevents liquid carry-over and provides visual indication when tripped.

E. Heavy duty contactor.

F. Modular control board with replaceable components.

2.13 LP GAS VALVES

A. Above ground service valves to be Smith 512-T series or approved equal UL listed at 300 psi for LP gas, natural gas and flammable liquids. Apollo Series 80 valves or approved equal are also acceptable.

2.14 LP GAS SPECIALTY VALVES, DEVICES AND FITTINGS

A. Relief Valves - Internal tank relief valves - 280 psig start-to-discharge setting - UL and ASME rated, stainless steel parts.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01- Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. General: Mechanical Contractor shall provide all excavation and backfill for installation of electrical wiring, chiller piping and vapor line from vaporizer and chiller to building as required. Coordinate with affected Contractors.

B. Install LPG piping in accordance with NFPA 58.

C. Remove scale and dirt on inside of piping before assembly.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Exterior buried piping shall be protected by a minimum of three (3) feet of earth cover. A continuous 2" wide warning tape shall be buried one foot below grade directly over the gas line. Provide a necessary "anode bag" and proper wiring to protect all of this buried piping.

G. All surfaces affected in the installation of the vapor line shall be restored to match existing adjacent surfaces and to meet approval of the Engineer and Architect.

3.4 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install LPG piping in accordance with NFPA 58.

B. Union, plug cock and drip leg required at all points of use for propane gas.

C. Support all piping, regulators on pipe stands mounted in concrete detail shown on drawings.

D. Piping exposed to the weather shall receive two coats of paint.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient.

G. Install piping to conserve building space and not interfere with use of space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.

K. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 230529.

L. Provide clearance for installation of insulation and access to valves and fittings.

M. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08 .

N. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer. Refer to Division 05.

O. Install vent piping from gas pressure reducing valves to outdoors and terminate to make weatherproof.

P. Install identification on piping systems including underground piping. Refer to Section 230553.

Q. Install valves with stems upright or horizontal, not inverted.

R. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

3.5 LP GAS TANK INSTALLATION

A. This contractor shall provide all necessary concrete piers for supporting the tank.

B. Provide crushed rock over a weed-stop fabric to a depth of 6".

C. Chain link fence with two access/doors to be provided by others.

D. Concrete pad to be provided by others.

E. Perform all demolition of existing tanks, vaporizer and piping as required for installation of new LP system.

3.6 GAS SHUTOFF VALVE

A. Install a main shutoff gas valve before the first branch line. The main shutoff valve shall be installed in the first available location inside the building that provides ready access and shall have a permanently attached handle. Install as per Minnesota Rules 1346.5409 section 409.1.4.

3.7 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Pressure test LPG piping in accordance with NFPA 58.

3.8 FACTORY FIELD SERVICES

A. All units must be started by factory authorized representative before equipment is used for any purpose. An approved start-up report must be forwarded to Engineer for approval before continued use of equipment.

B. Provide Owner training for fuel switchover procedure. Provide a fuel system schematic diagram showing system components and a concise step-by-step procedure for the switchover process. Permanently mount documents in Boiler Room. Documents must be stain and

moisture resistant. Owner training shall be provided by factory-authorized representative. Document training method and date in Operations and Maintenance Manuals.

3.9 GAS PIPE PAINTING

A. All new gas piping shall be cleaned and all exposed gas piping shall be given two coats of yellow Rustoleum. All concealed gas piping shall be given one coat of yellow Rustoleum. Exterior gas pipe against an outside wall shall be painted to match the wall.

END OF SECTION

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SECTION 221300 - FACILITY SANITARY SEWERAGE AND SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewer piping buried within 5 feet of building.
2. Sanitary sewer and vent piping above grade.
3. Mechanical equipment drains.
4. Unions and flanges.
5. Floor drains.
6. Floor sinks.
7. Trench drains.
8. Flammable Waste Trap.
9. Cleanouts.
10. Bedding and cover materials.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
3. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
4. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
5. Section 230516 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
6. Section 230529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
7. Section 230553 - Identification for HVAC Piping, Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
8. Section 230700 - HVAC and Plumbing Insulation: Product and execution requirements for pipe insulation.
9. Division 31 - Soils for Earthwork: Soils for backfill in trenches.
10. Division 31 - Aggregates for Earthwork: Aggregate for backfill in trenches.
11. Division 31 - Excavation: Product and execution requirements for excavation and backfill required by this section.
12. Division 31 - Trenching: Execution requirements for trenching required by this section.
13. Division 31 - Fill: Requirements for backfill to be placed by this manholes section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.21.1 - Floor Drains.
2. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
3. ASME B16.3 - Malleable Iron Threaded Fittings.
4. ASME B16.4 - Gray Iron Threaded Fittings.
5. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
6. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
7. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 - Standard Specification for Ductile Iron Castings.
7. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
8. ASTM B32 - Standard Specification for Solder Metal.
9. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
10. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
11. ASTM B75 - Standard Specification for Seamless Copper Tube.
12. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
13. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
14. ASTM B302 - Standard Specification for Threadless Copper Pipe.
15. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
16. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
17. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
18. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
19. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
20. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
21. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
22. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
23. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

24. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
25. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
26. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
27. ASTM D2662 - Standard Specification for Polybutylene (PB) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
28. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
29. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
30. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
31. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
32. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
33. ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
34. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
35. ASTM D3262 - Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
36. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
37. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
38. ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Non-pressure Applications.
39. ASTM F441 - CPVC Plastic Pipe, Schedules 40 and 80.
40. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
41. ASTM F493 - Solvent Cements for CPVC pipe and fittings.
42. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core.
43. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
44. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

D. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for use in connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping applications.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for interceptors, and manholes.

C. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for equipment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. The Contractor shall be responsible for the proper installation and working of everything in their portion of the project and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from the date of Substantial Completion of the work (unless noted otherwise as a longer warranty period in an individual specification section). Refer to Division 01 for more details.

PART 2 PRODUCTS

2.1 SANITARY SEWER AND VENT PIPING, BELOW & ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, Service Weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: Neoprene gasket and stainless steel clamp and shield assemblies conforming to CISPI 310.

B. PVC Pipe: ASTM D2665, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

1. Fittings: ASTM D2466, Schedule 40, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.2 EQUIPMENT DRAIN AND OVERFLOW LINES

A. Copper Tubing: ASTM B88, Type M and DWV, hard drawn. (Shall be insulated.).

1. Fittings: ASME B16.18, cast brass or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C).

B. PVC Pipe: ASTM D1785, Schedule 40. (No insulation necessary).

1. Fittings: ASTM D2466 or D2467, PVC.
2. Joints: ASTM D2955, solvent weld.

2.3 CHEMICAL RESISTANT BOILER & WATER HEATER CONDENSATE PIPING

A. Condensate piping shall be manufactured from CPVC Type IV Grade I compounds with a minimum cell classification of 23447. Pipe and Fittings shall conform to ASTM F 2618 and IAPMO IGC 210-2005a. Pipe shall be Schedule 40 dimensions. One-Step solvent cement

shall be specially formulated for chemical waste applications and conform to ASTM F493. All pipe, fittings and cement shall be supplied as a system by a single manufacturer and shall be certified by NSF International for use in corrosive waste drainage systems and shall bear the mark “NSF-cw”. Condensate Piping to be the ChemDrain system as manufactured by Charlotte Pipe and Foundry Co. Installation to be in accordance with manufacturer’s instructions and all applicable local code requirements. The system is intended for use in non-pressure chemical waste applications with a maximum working temperature of 220° F. Lab-waste system as manufactured by Spears shall be considered equal.

2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Copper Piping: Class 150, bronze unions with soldered joints.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
3. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16 inch thick pre-formed neoprene.
2. PVC Piping: PVC flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

D. Grooved and shouldered pipe end couplings: malleable iron housing clamps to engage and lock, designed to permit some angular, contraction, and expansion; "C" shape composition sealing gasket; steel bolts, nuts, washers; galvanized couplings for galvanized pipe.

2.5 FLOOR DRAINS

A. Manufacturers:

1. Zurn.
2. Wade.
3. J. R. Smith.
4. Mifab.
5. Josam.

B. Floor Drain FD-1: ASME A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer. Model #ZN415-5B manufactured by Zurn. (FD-1 locations shall be for emergency use only and shall not require venting per MN Code).

C. Floor Drain FD-2: SAME AS FD-1 but not classified as an emergency type floor drain and shall require venting.

D. Floor Drain FD-3: ASME A112.21.1; same as FD-2 except with polished bronze funnel type strainer; Model ZB415-5B manufactured by Zurn.

E. Floor Drain FD-4: ASME A112.21.1; same as FD-2 except strainer shall be 8" diameter. Model ZN415-8B manufactured by Zurn.

F. Floor Drain FD-5: ASME A112.21.1; lacquered square top drain, cast iron body with bottom outlet, seepage pan and combination membrane flashing clamp and frame for heavy duty cast iron loose slotted grate with suspended sediment bucket: Model Z610H manufactured by Zurn.

2.6 FLOOR SINKS

A. Manufacturers:

1. Zurn.
2. Wade.
3. Smith.
4. Mifab.
5. Josam.

B. Floor Sink FS-1: Square lacquered cast iron body with integral seepage pan, epoxy coated interior, dome strainer, sediment bucket, epoxy coated, nickel bronze frame and half-grate. Model Z-1901 manufactured by Zurn.

2.7 TRENCH DRAINS

A. Manufacturers.

1. ABT, Inc.
2. ACO Polymer Products Inc.:
3. Eric’sons Dura-Trench Inc.:
4. Jay R. Smith Manufacturing Company:
5. MEA-Josam:
6. Watts.
7. Zurn Industries, Inc:

B. Trench Drain TD-1:

1. Watts Dead Level ‘D’ Pre-Sloped Trench Drain System with 6” wide x 48” long ductile iron frame, UV stabilized talc-filled polypropylene channels with integral 4” no-hub bottom or end outlets. System shall be frame anchored, with Ductile Iron grating to suit DIN class E load rating. System to include frame connectors, grate lockdowns, and construction covers. Installation to be performed in accordance with manufacturer's installation instructions. The Plumbing Contractor shall work closely with General Contractor for installation of trench and when concrete is poured.

2.8 CLEANOUTS

A. Manufacturers:

1. Zurn.
2. Wade.
3. J.R. Smith.
4. Mifab.

B. Exterior and Unfinished Surfaced Areas (CO-1): Round cast nickel bronze access frame and non-skid cover. Model ZN1400-2HD manufactured by Zurn.

C. Interior Finished Floor Areas (CO-2): Lacquered cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel-bronze cover, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas and stamped stainless steel cleanout marker in carpeted areas; Model ZN1400-2 manufactured by Zurn.

D. Interior Finished Wall Areas (CO-3): Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw; Model Z1445-1 manufactured by Zurn.

E. Interior Unfinished Accessible Areas (CO-4): Caulked or threaded type. Provide bolted stack cleanouts on vertical rain water leaders.

F. FLAMMABLE WASTE TRAP - FWT-1.

1. Products: Striem Products Model FWT-35, or approved equal, with field adjustable riser system, molded-in lift handles, forklift ready underbelly and tie-down point for anchoring the unit to the substrate, cover, inlet, outlet, and vent connections, and lifetime guaranteed.
2. Body Material: 3/8-inch uniform wall thickness of seamless molded high density polyethylene tank.
3. Body Dimensions: 42" in diameter x 72-1/2-inch High, plus field adjustable riser system.
4. Liquid Capacity: 262 gallons (35 cu. ft.).
5. Cover: Composite and gasketed cover, constructed to a minimum H-20 traffic rating - 16,000 lb. capacity (standard).
6. Riser System: TeleGlide fully adjustable riser system for below grade installations.
7. Inlet and Outlet Size: 4-inch.
8. End Connections: Schedule 40 Plain End No-Hub.
9. Vent Size: 2-inch.
10. Mounting: Recessed, flush with floor.
11. Depth: 3ft. minimum below the invert of the discharge drain. Field verify building invert for total height requirements.
12. Minnesota State Plumbing Code Approved.

2.9 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Division 31.

B. Cover: Fill Type as specified in Division 31.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Division 31. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing. Make connection for sewer services to outside utilities located 5’-0” from building.

3.2 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.4 EXCAVATION AND BACKFILLING

A. Underground Work (Inside the Buildings Outside Walls).

1. Mechanical Contractor to carry out all excavation, backfilling and compaction of earth required for the installation of underground lines within the buildings outside walls.
2. All backfill (on excavations inside of the building outside perimeter walls) shall be vibratory rolled or otherwise compacted to 95 percent of proctor density, tested at the rate of one test per 2500 sq. ft and re-packed and retested where the test results are under.
3. Mechanical Contractor shall note inverts of the sanitary runs inside and outside of the buildings and shall run lines to meet these inverts. Where these lines cross underground foots or foundations the Mechanical Contractor shall provide oversize steel pipe sleeves before foundations are poured.

3.5 TESTING REQUIREMENTS

A. The sanitary sewer and vent piping systems shall be tested as per Minnesota Plumbing Code 4714.

B. As per Minnesota Rules Part 4714, no plumbing work may be covered prior to completing the required tests and inspections.

C. Mechanical Contractor shall verify that the Minnesota Department of Labor and Industry has reviewed the Drawings for this Project prior to asking for an inspection of the underground piping.

D. Submit certification to Engineer showing that all necessary and required tests were performed for the entire Project including the following:

1. Sewer/Vent piping.

3.6 SEWER AND DRAIN PIPING NEAR WATER PIPING

A. All underground sections of building drain and building sewer pipe located within 10 feet of buried water supply pipe shall be constructed in accordance with Minnesota Rules.

3.7 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connections to existing piping systems size, location, and invert are as indicated on Drawings.

B. Establish minimum separation of 10’-0” from water services.

C. Remove scale and dirt on inside of piping before assembly.

D. Excavate pipe trench in accordance with Division 31.

E. Install pipe to elevation as indicated on Drawings.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

H. Install trace wire continuous over top of pipe, buried 12 inches below finish grade, above pipe line; coordinate with Division 31.

I. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Division 31.
2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

J. Install a cleanout where there is an increase in pipe size from 2 inches to 3 inches and from 3 inches to 4 inches.

3.8 INSTALLATION - PIPING

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients. Piping 4” or larger shall slope at 1/8” per foot where noted to meet invert requirements.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom. Do not spread piping, conserve space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.

I. Install piping penetrating roofed areas to maintain integrity of roof assembly.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

L. Install bell and spigot pipe with bell end upstream.

M. Sleeve pipes passing through partitions, walls and floors.

N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 230529.

O. Support cast iron drainage piping at every joint.

P. Cleanouts shall be provided where new waste, storm and vent piping connects with existing plumbing so the new system can be tested.

Q. Plumbing vents shall extend a minimum of 12" above roof. Install frost-proof flashing over vent. Verify final HVAC equipment and air intake locations and confirm required clearances.

R. Plumbing vents shall be a minimum of 15’-0" away from roof-mounted or wall-mounted fresh air intakes. Verify final HVAC equipment and air intake locations and confirm required clearances.

S. Solvent weld joints in PVC and CPVC pipe shall include use of a primer which is of contrasting color to the pipe and cement.

T. All piping shall be installed in accordance with the Minnesota Plumbing Code.

U. PVC pipe shall not be installed in return air plenums.

3.9 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements, Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

END OF SECTION

SECTION 221500 - GENERAL SERVICE COMPRESSED AIR SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Compressed air piping.
2. Unions and flanges.
3. Valves.
4. Compressor.
5. Compressed air outlets.
6. Air pressure reducing valve.
7. Hose Reels.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 09 - Painting and Coating: Execution requirements for painting material specified by this section.
3. Section 230529 - Hangers and Supports for HVAC Piping and equipment for placement by this section.
4. Section 230553 - Identification for HVAC Piping, Plumbing Piping and Equipment: Product requirements for pipe and valve identification for placement by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

C. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

C. Product Data: Submit manufacturers catalog literature with capacity, weight, and connection requirements.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, replacement part numbers and availability.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept equipment on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

C. Protect piping and equipment from weather and construction traffic. Maintain factory packaging and caps in place until installation.

D. Deliver each length of piping with manufacturer’s plugged or capped ends and keep sealed until installation.

E. Deliver fittings, valves, and other components in sealed containers and keep sealed until installation.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.1 B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

1.7 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance materials.

1.8 WARRANTY

A. Furnish five (5) year manufacturer warranty. Under provisions of Division 01.

PART 2 PRODUCTS

2.1 COMPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Review list below if AMCA-certified fans are required; not all manufacturers are AMCA members.
2. Quincy QT-7.5 (Basis of Design).
3. Curtis.

B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.

1. Submerged gear-type oil pump.
2. Oil filter.
3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
4. Belt guard totally enclosing pulleys and belts.
5. Factory installed air cooled aftercooler specifically sized for compressor.

C. Capacities and Characteristics:

1. Air Compressor(s): 2-Stage Belt-Drive w/ Solid Cast Iron Cylinder.
2. Actual-Air Capacity of Each Air Compressor: 22.6 SCFM at Max PSI.
3. Max. Discharge-Air Pressure: 175 psig.
4. Mounting: Tank mounted.
5. Motor: 7.5-HP.
6. Voltage: 208v.
7. Extended Warranty: Yes (2 year package, 3 year pump).

D. Receiver: ASME construction steel tank.

1. Arrangement: Horizontal.
2. Capacity: 80 Gallon.
3. Interior Finish: None.
4. Pressure Rating: 145-175 PSI Working.
5. Pressure Regulator Setting: 150 psig Verify w/ Owner.
6. Pressure Relief Valve Setting: 175 psig.
7. Drain: Automatic and Manual valve.

2.2 GENERAL PURPOSE FILTER

A. Approved Manufacturers:

1. Norgren.
2. Or approved equal prior to bidding.

B. Filter capacity shall be greater than the compressor's free air capacity with less than 2 psig pressure drop across the filter.

C. Filter shall be capable of removing soil particles down to 5 microns.

D. Filter shall be screwed down type, capable of disassembly and maintenance, without removal from air line.

E. Filter shall have metal bowl, rated 250 psig with sight glass and automatic drain.

2.3 COMPRESSED AIR PIPING

A. Copper Tubing: ASTM B88, Type L hard drawn.

1. Fittings: ASME B16.18 cast, bronze or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Copper Piping: Class 150, bronze unions with soldered joints.

2.5 BALL VALVES

A. Manufacturers: 1/4" to 2-1/2."

1. Crane.
2. Hammond.
3. Milwaukee - BA400 or BA457.
4. NIBCO - T/S-585.
5. Watts - 6080.
6. Apollo - Model 77-600#WOG. (Option: 82/100/200).
7. Substitutions: Division 01 - Product Requirements.

B. Up to 2-1/2 inches: MSS SP 110, bronze, two piece body, chrome plated ball, full port, 600 psig working pressure, Teflon seats, blow-out proof stem, and solder ends.

2.6 COMPRESSED AIR OUTLETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aeroquip Corporation; Eaton Corp.
2. Bowes Manufacturing Inc.
3. Foster Manufacturing, Inc.
4. Milton Industries, Inc.
5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
6. Rectus Corp.
7. Schrader-Bridgeport; Amflo Div.
8. Schrader-Bridgeport/Standard Thomson.
9. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
10. TOMCO Products Inc.
11. Tuthill Corporation; Hansen Coupling Div.

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: Straight-through type with barbed outlet for attaching hose.

D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug End: With barbed outlet for attaching hose.

2.7 HOSE REELS - HR-1

A. Manufacturers:

1. Graco.
2. Lincoln.
3. Reelcraft.
4. Balcrank.
5. Or approved equal manufacturer prior to bidding.

B. HR-1 - Hose reels shall have 1/2” inlet, 1/2” outlet, 300 PSI max pressure, self-aligning, ball stop kit, label kit and instruction manual. XD Series as manufactured by Graco.

1. Air reel hose assembly shall contain a 1/2”x35’ hose, Model # XDL33B with inlet hose kit #218549.
2. Provide brackets and supports for overhead mounting.

C. HR-2 - Hose reels shall have 1/2" inlet, 1/2" outlet, 300 PSI max pressure, self-aligning, ball stop kit, label kit and instruction manual. XD Series as manufactured by Graco.

1. Air reel hose assembly shall contain a 1/2"x75' hose, Model # HSLC8B with inlet hose kit #218549.
2. Provide brackets and supports for overhead mounting where required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connection to existing piping system size and location as indicated on Drawings.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS

A. Install drip connections with valves at low points of piping system.

B. Install take-off to outlets from top of main, with shut off valve after take off. Slope take-off piping to outlets.

C. Install compressed air couplings and female quick connectors where outlets are indicated.

D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

E. Cut pipe and tubing accurately and install without springing or forcing.

F. Slope piping in direction of flow.

G. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions. Refer to Section 230529.

H. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

I. Install pipe identification in accordance with Section 230553.

J. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.

3.4 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Piping System Tests: Cap and fill compressed-air piping with oil-free, dry air, or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four (4) hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for two (2) hours with no drop in pressure.

1. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

3.5 CLEANING

A. Division 01 - Execution Requirements: Requirements for cleaning.

B. Blow systems clear of free moisture and foreign matter.

END OF SECTION

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SECTION 223100 - WATER TREATMENT SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes.

1. Water Softener.

B. Related Sections:

1. Section 221100 - Facility Water Distribution: Supply connections to domestic water conditioning equipment.
2. Section 230529 - Execution requirements for Housekeeping Pads.
3. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit capacity, electrical characteristics and connection requirements. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, drains, controls, and operating sequence.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit operation, maintenance, and inspection data, replacement part numbers and availability.

C. Maintain one copy of each document on site.

1.4 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.5 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. The equipment manufacturer shall provide a warranty of two-years from the time of substantial completion, (whichever is shorter) against defects in materials and/or workmanship of the mechanical operation. The pressure vessel(s) shall include a full five-year warranty from date of manufacture, when operated under normal conditions. Vessel(s) are not warranted to withstand a vacuum of more than 5 inches of HG (mercury).

1.9 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 WATER SOFTENERS

A. Acceptable Manufacturers:

1. Culligan.
2. Wigen Water.
3. Water Control Corporation.

2.2 WATER SOFTENER # WS-1

A. General: The system shall be a progressive flow commercial Culligan model # CTM-210 Consiting of (3)Three resin tanks and (1)one brine tank. System designed to handle a continuous flow rate of 123 gpm at a pressure loss not exceeding 7 psi, and a peak flow rate of 195 gpm at a pressure loss not exceeding 15 psi. System shall have a softening capacity of not less than 161,000 grains of softening per regeneration, with a salt dosage of 7 lbs per cubic foot of resin used.

B. Resin Tanks: The system shall incorporate 3 resin tanks, a minimum of 21 inches in diameter and 62" tall. The tank volume shall be sufficient to allow a minimum freeboard space of 50 percent of the resin depth for adequate expansion of the resin during backwashing. Tank shall be designed for an operating pressure up to 150 psi and shall be manufactured of fiberglass reinforced polyester, reinforced with a continuous roving glass filament overwrap. Tank shall have a molded polypropylene base for support.

C. Distributor System Softener tanks shall be equipped with a hub and lateral type distributor system, with a plastic riser pipe and a fine slotted bottom distributor assembly. The bottom assembly shall be covered with a minimum of 3 inches of underbed gravel to insure even distribution of water.

D. Softening Media Softener tank shall be provided with 7 cubic feet of high capacity synthetic cation exchange resin having a maximum exchange capacity of 32,000 grains per cubic foot when regenerated with 15 lbs of salt per cubic foot. The resin shall be manufactured to comply with the food additive regulation, paragraph 121.1148 of the Food and Drug Administration.

E. Brine System A combination salt storage and brine tank, measuring 30 inches in diameter by 48 inches tall, with cover shall be provided. The tank shall be molded of corrosion proof, high density polyethylene. The tank shall be equipped with an a chamber to house a brine check assembly. The brine check shall automatically open during eduction, and close automatically to prevent introduction of air into resin tank.

F. Automatic Controls: Tank shall incorporate a top mounted control valve. The control valve shall be of all brass construction, multi-port for maximum flow, and have a 2 inch npt inlet and outlet. Valve shall be motor driven, top mounted, mechanically activated design with five positions to accomplish the regeneration steps of backwash, brine and rinse, rapid rinse,brine refill, and service. The control shall be fitted with a brine injector assembly, and a self adjusting backwash flow control. System shall include a 2 inch meter located on the outlet side of the softener.

G. Start-up: Start-up and initial system operation training shall be performed by factory representative. Contractor shall provide an initial salt fill of a minimum 300 lbs.

H. Electrical Requirements: Each individual valve (3 total) shall be pre-wired with a 3-prong plug, complete with in-line 5 Amp breaker, for GFI wall outlet connection. Unit shall operate at 120 VAC, 3.5 Amps FLA, 60 Hz. Total quantity of GFI outlets required is three (3).

I. Warranty: Equipment manufacturer shall provide a minimum of one-year warranty against factory defects.

PART 3 EXECUTION

3.1 WATER SOFTENER INSTALLATION

A. Installation: Provide dielectric unions where copper touches dissimilar metals. Clean up entire area when installation is complete. Manufacturer shall have locally-based service and repair facility and experienced service persons. Water-softening equipment will be guaranteed against failure due to faulty workmanship, materials and corrosion for a period of one year. Replacement or repair of defective parts during guarantee shall be done at no cost to owner.

Before final acceptance by owner, the system shall be complete and ready for operating. Fill brine tanks to capacity with salt. Start-up of system shall be made by manufacturer's representative who shall check and, if necessary, correct any mechanical deficiency in system and instruct owner's representative in water test procedures. Prepare and furnish two (2) copies of bound brochures listing equipment and appurtenances to include parts list and service instruction. Include a complete water analysis report of the raw water. Instruct owner or his representative in the operation, maintenance and service of the system and system components.

B. Installation: Clean up entire area when installation is complete. Manufacturer shall have locally-based service and repair facility and experience service persons. Water-softening equipment will be guaranteed against failure due to faulty workmanship, materials and corrosion for a period of one year. Replacement or repair of defective parts during guarantee shall be done at no cost to owner. Before final acceptance by owner, the system shall be complete and ready for operating. Start-up of system shall be made by manufacturer's representative who shall check and, if necessary, correct any mechanical deficiency in system and instruct owner's representative in water test procedures. Prepare and furnish two (2) copies of bound brochures listing equipment and appurtenances to include parts list and service instruction. Include a complete water analysis report of the raw water. Instruct owner or his representative in the operation, maintenance and service of the system and system components.

END OF SECTION

SECTION 223400 - FUEL-FIRED WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. Work Results:

B. Principal Products:

C. This section includes condensing gas-fired storage water heaters for potable water.

1.3 REFERENCES

A. ASME Boiler and Pressure vessel code, section IV, Part HLW.

B. UL 795 “Industrial Gas Heating Equipment”.

C. ANSI Z21.10.3 -2004/CSA 4.3-2004 “Gas Water Heaters”.

D. ASHRAE/IES 90.1-2010.

E. ISO 9001 Quality Management System.

F. CSD-1-2009 “Controls and Safety Devices for Automatically Fired Boilers”.

G. NFPA 70- National Electric Code.

H. NFPA 54- National Fuel Gas Code.

I. NSF/ANSI Standard 61- Drinking Water System Components.

J. ASTM G123 - 00(2005) “Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution.”.

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties and accessories for each model indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, components, and size of each field connection.

C. Wiring Diagrams: Detail for wiring power signal, differentiate between manufacture- installed and field-installed wiring.

D. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include maintenance guide and wiring diagrams.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for internal wiring of factory wired equipment.

B. Units: ETL, UL or CSA Certified as a Complete Gas Fired Water Heater Assembly.

C. Gas Train shall comply with ANSI Z.21.10.3 or UL 795.

D. Conform to ASME Section IV. Part HLW for Water Heater construction.

1.6 QUALITY ASSURANCE

A. Listing: The water heater will be listed ETL listed to UL 795 or ANSI Z21.10.3 -2004/CSA 4.3-2004 “Gas Water Heaters”.

B. ASME Compliance: Water heater shall bear the ASME HLW stamp and be National Board listed.

C. Water heaters with full rated input between 399,000 and 600,000 BTU will operate at a minimum 96% thermal efficiency at full firing rate when tested to the ANSI Z21.10.3 thermal efficiency test protocol (DOE 10 CFR 431).

D. The water heater shall comply with current ASHRAE 90.1 requirements.

E. Water heater manufacturer certified to the ISO 9001 International Quality System.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Install water heater with access for serving per manufacturers recommendations.

1.8 WARRANTY

A. Storage tank(s), heating surfaces, and combustion chamber will have a 15 (fifteen)-year warranty covering manufacturing or material defects, leaks, and/or the production of rusty water.

B. Stress Corrosion Cracking Warranty - - 10 (ten)-year, non-prorated coverage for failure of tank or heat exchanger due to chloride-induced stress corrosion cracking with no limit to the level of dissolved chlorides in the potable water supply.

C. Burner and all heater parts: 1 year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum twenty years' experience. The water heaters shall be manufactured by a company that has achieved certification to the ISO 9001Quality Management System.

B. The water heaters shall be ETL listed as a complete unit. The heater shall satisfy current Federal Energy Policy Act standards for both thermal efficiency and stand-by heat losses as established for gas fired water heaters.

C. Manufacturers: PVI Conquest model is the basis of design. Acceptable manufacturers shall be subject to compliance with the requirements.

2.2 CONSTRUCTION

A. Water heaters will be of the BTU input(s) and storage capacity indicated on the equipment schedule.

B. The water heater will be a vertical fire tube, design that is constructed and stamped in accordance with Section IV, Part HLW of the ASME code. Water heater will be National Board Registered for a working pressure of 150 psi and will be pressure tested at 1-1/2 times working pressure.

C. Water heater will be a single-pass, down-fired, spiraled fire tube design contained within an integral storage tank.

D. Tank, combustion chamber and fire tubes will be unlined. Lined or plated water heaters will not be acceptable.

E. Tank, combustion chamber and fire tubes will be constructed from phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion and mill certified per ASTM A 923Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance. The material selected shall be tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2and ASTM G123 - 00(2005) "Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution.".

F. Waterside surfaces shall be welded internally utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.

G. All internal and external tank surfaces shall undergo full immersion passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required

to complete corrosion resistance restoration of pressure vessel surfaces. Other passivation and pickling methods are not accepted. Immersion passivation and pickling certification documents are required and shall be provided with each product.

H. Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. Storage tank materials shall contain more than 80% post-consumer recycled materials and be 100% recyclable.

I. All water contacting tank surfaces will be non-porous and exhibit 0% water absorption.

J. All tank connections/fittings will be non-ferrous or stainless steel.

K. To preserve thermal efficiency, the water heater will not use or require a circulator piped from the hot water outlet to the cold water inlet of the heater for the purpose of temperature control during normal operation. Connection for a building return circulation line will be made to a dedicated hot return fitting at the center of the storage vessel and not the cold inlet piping. Connection to a sidearm tank, if used, will be made to a dedicated hot return fitting at the center of the storage vessel and not the cold inlet piping.

L. Finished vessel will not require sacrificial anode rods and none will be used. Water heaters or sidearm storage tanks that employ anode rods of any type will not be acceptable.

M. Combustion will be provided by a premix, fan-assisted surface burner with a gas train meeting UL, ANSI and FM standards for the input specified.

N. Burner will be stainless steel.

O. Gas train components will capable of self-proportionating gas and air to maintain optimum combustion in response to varying vent pressures.

P. At 199,000 to 999,000 BTU input, the burner will employ pulse-width modulation.

Q. Burner NOx emissions will be less than 20 ppm when corrected to 3% oxygen.

R. Water heater will be a category IV, condensing appliance and vent through PVC or Polypropylene. Water heater will satisfy requirements for sealed combustion. Vents for inlet air and exhaust can terminate in different pressure zones.

S. Water heater will be ETL listed for connection to a concentric vent termination.

T. The storage tank will not require anodes of any type and none will be used.

U. Manufacturer shall furnish condensate neutralizer system kits along with water heaters.

V. Provide gas pressure regulator with water heater.

2.3 PERFORMANCE

A. When tested to the ANSI Z21.10.3 standard, water heaters with inputs of all ranges shall operate at a minimum 96% thermal efficiency at full firing rate or higher based on published data.

B. Water heater shall meet the thermal efficiency and standby heat loss requirements of ASHRAE 90.1-2010.

2.4 WATER HEATER TRIM

A. As a minimum, the heater will be equipped with the following:

1. electronic flame monitoring.
2. electronic low water cutoff.
3. an immersion operating control.
4. an immersion UL listed temperature limiting device.
5. an ASME- rated temperature and pressure relief valve.
6. and options as selected on form PV 8293.
7. UL 795 compliant gas train.

B. Operating and safety controls shall meet the requirements of UL 795 and FM.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install water heaters level and plumb on housekeeping pad in accordance with manufacturers written instructions and referenced standards.

3.2 FINISHING

A. The storage and heating sections shall be completely factory packaged on a single skid, requiring only job site hookup to utilities, venting, and plumbing. The heater shall be insulated to meet ASHRAE 90.1 standby loss requirements and jacketed with a polyethylene liner consisting of 100% recycled material. Pressure vessel shall include a ball-type drain valve. The heater shall fit properly in the space provided and installation shall conform to all local, state, and national codes.

3.3 START-UP

A. Start up on the unit will be performed by factory trained and authorized personnel. A copy of the startup report will be provided to the owner.

END OF SECTION

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SECTION 224000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Urinals.
3. Lavatories.
4. Wash Fountains.
5. Service sinks.
6. Showers.
7. Sinks.
8. Electric water coolers.
9. Emergency Fixtures.
10. Utility Outlet boxes.

B. Related Sections:

1. Section 079200 - Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
2. Section 221100 - Facility Water Distribution: Supply connections to plumbing fixtures.
3. Section 22 1300 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
4. Section 230500 - Basic Fire Protection, Plumbing and HVAC Requirements.
5. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI Z358.1 - Emergency Eyewash Equipment.

B. Air-Conditioning and Refrigeration Institute:

1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:

1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Plumbing Fixture Fittings.
3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
5. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. All flush valves for water closets and urinals shall be provided by the same manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Faucets: All faucets must comply with NSF 61 - Drinking Standards.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

C. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.7 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. The Contractor shall be responsible for the proper installation and working of everything in their portion of the project and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give or gives rise to trouble of any kind for a period of one year from the date of Substantial Completion of the work (unless noted otherwise as a longer warranty period in an individual specification section). Refer to Division 01 for more details.

PART 2 PRODUCTS

2.1 SILICONE FOAM PLUMBING CAULKING AND SEALANTS

A. Foam to be Dow Corning 3-6548 Silicone RTV Foam.

B. Sealant to be Dow Corning 96-081 RTV Silicone Adhesive sealant.

2.2 CAULKING AND SEALANTS

A. Material shall be asbestos-free, having code approvals as listed in Article 1.03 of this specification.

2.3 ACCEPTABLE MANUFACTURERS - ADA DRAIN & SUPPLY INSULATION

A. IPS Corporation - Truebro®.

B. Goodwill Industries.

C. McGuire.

D. Plumberex Specialty Products.

2.4 HANDICAPPED LAVATORY INSULATED PROTECTORS

A. Handicap lavatory P-trap and angle valve assemblies shall be insulated with the fully molded, IPS Corporation “TRUEBRO”, Lav Guard 2 undersink piping covers, White in color.

2.5 ACCEPTABLE MANUFACTURERS - FIXTURES

A. Kohler.

B. Crane.

C. Eljer.

D. American Standard.

E. Sloan.

F. Zurn One.

G. Fiat.

H. E.L. Mustee.

I. Advance Tabco.

2.6 ACCEPTABLE MANUFACTURERS - FIXTURE TRIM

A. Moen.

B. Chicago.

C. Kohler.

D. Symmons.

E. Delta.

F. Zurn.

2.7 ACCEPTABLE MANUFACTURERS - STAINLESS STEEL SHOWERS

A. Bradley.

B. Intersan.

C. Acorn.

D. Willoughby.

2.8 ACCEPTABLE MANUFACTURERS - FLUSH VALVES

A. Sloan.

B. Zurn.

C. Chicago.

D. American Standard.

2.9 ACCEPTABLE MANUFACTURERS - WATER CLOSET SEATS

A. Church.

B. Kohler.

C. Bemis Mfg. Co.

D. Olsonite.

2.10 ACCEPTABLE MANUFACTURERS - FIXTURE CARRIERS

A. Zurn Ind.

B. J.R. Smith.

C. Wade.

D. Josam.

E. Ancon.

2.11 ACCEPTABLE MANUFACTURERS - ELECTRIC WATER COOLERS

A. Elkay.

2.12 ACCEPTABLE MANUFACTURERS - EMERGENCY SAFETY EQUIPMENT

A. Stingray.

2.13 ACCEPTABLE MANUFACTURERS - STAINLESS STEEL SINKS

A. Elkay.

B. Just.

2.14 ACCEPTABLE MANUFACTURERS - WASH FOUNTAINS

A. Bradley.

B. Acorn.

C. Or Approved equal prior to bidding.

2.15 ACCEPTABLE MANUFACTURERS - MISCELLANEOUS FITTINGS

A. Zurn.

B. Wolverine Brass.

C. Brass Craft.

D. Dearborn Brass.

E. McGuire.

F. Promax.

2.16 MISCELLANEOUS FITTINGS

A. Miscellaneous fittings shall include P.O. plugs, basket strainers, lavatory supplies, closet supplies and traps.

2.17 PLUMBING FIXTURES

A. FLOOR SET WATER CLOSET, ADA - WC-1.

1. ASME A112.19.2; Complete HET system with exposed, sensor activated, electronic dual-flush hardwired flushometer, and ADA compliant vitreous china floor-set fixture. 1.6 GPF, Model # WETS-2022.1303 as manufactured by Sloan.
2. Seat: Solid white plastic, open front, extended back, self-sustaining ring, stainless steel bolts with cover; Model # 1955SSCT manufactured by Bemis.

B. FLOOR SET WATER CLOSET, STANDARD - WC-2.

1. ASME A112.19.2; Complete HET system with exposed, sensor activated, electronic dual-flush hardwired flushometer, and vitreous china floor-set fixture. 1.6 GPF, Model # WETS-2700.3003 as manufactured by Sloan.
2. Seat: Solid white plastic, open front, extended back, self-sustaining ring, stainless steel bolts with cover; Model # 1955SSCT manufactured by Bemis.

C. PRE-K AREA WATER CLOSET - WC-3.

1. ASME A112.19.2; Complete system with manual flushometer, and 13-1/2” high vitreous china floor-set fixture. 1.6 GPF, Model # WETS-2449.1001 as manufactured by Sloan.
2. Seat: Solid white plastic, open front, extended back, self-sustaining ring, stainless steel bolts with cover; Model # BB955CT manufactured by Bemis.

D. URINAL - UR-1 & UR-1A.

1. ASME A112.19.2; Complete HEU system with exposed, hardwired automatic flush valve, and vitreous china wall hung fixture.125 GPF, Model # WEUS-1000.1411 as manufactured by Sloan.
2. Furnish and install a Zurn Series 1200 Fixture Carrier for wall hung urinals.

E. ADULT ADA PRIVATE WALL-HUNG LAVATORY - LAV-1.

1. Basin: ASME A112.19.2; Wall hung lavatory shall be made of vitreous china. Lavatory shall have an overflow. Lavatory shall be a 4” centerset. Model # SS-3003 as manufactured by Sloan.
2. Trim: ASME A112.18.1, Heavy Duty Cast Brass sink faucet, 4” Centers, two-handle 4” blades, polished chrome plated finish, gooseneck spout with limited swing option, vandal resistant, 1.5 GPM flow aerator, handle temperature indicators. Model # 27C4944 as manufactured by Delta. Furnish and install open grid strainer, chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.
3. Provide Mixing valve to maintain a constant temperature within EQ \O(+,_) 5°F and shall meet the requirements of ASSE 1070. Unit shall be nickel plated with 1/2" MNPT connections, spindle to adjust outlet temperature and internal checks. Model #570 as manufactured by Lawler.
4. Furnish and install a Zurn series 1200 fixture carrier for wall hung lavatories.
5. Furnish and install ADA wrap on supplies and traps.

F. ADA PUBLIC LAVATORY - LAV-2.

1. Basin: Integral countertop basin shall be scheduled by Architect.
2. Trim: ASME A112.18.1, Heavy Duty Cast Brass sink faucet, 4” Centers, two-handle 4” blades, polished chrome plated finish, gooseneck spout with limited swing option, vandal resistant, 0.5 GPM flow aerator, handle temperature indicators. Model # 27C4944 as manufactured by Delta. Furnish and install open grid strainer, chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.
3. Provide Mixing valve to maintain a constant temperature within EQ \O(+,_) 5°F and shall meet the requirements of ASSE 1070. Unit shall be nickel plated with 1/2" MNPT connections, spindle to adjust outlet temperature and internal checks. Model #570 as manufactured by Lawler.
4. Furnish and install ADA wrap on supplies and traps.

G. CHILDRENS HEIGHT ADA PRIVATE WALL-HUNG LAVATORY - LAV-3.

1. Basin: ASME A112.19.2; Wall hung lavatory shall be made of vitreous china. Lavatory shall have an overflow. Lavatory shall be a 4” centerset. Model # SS-3003 as manufactured by Sloan.
2. Trim: ASME A112.18.1, Heavy Duty Cast Brass sink faucet, 4” Centers, two-handle 4” blades, polished chrome plated finish, gooseneck spout with limited swing option, vandal resistant, 1.5 GPM flow aerator, handle temperature indicators. Model # 27C4944 as manufactured by Delta. Furnish and install open grid strainer, chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.
3. Provide Mixing valve to maintain a constant temperature within EQ \O(+,_) 5°F and shall meet the requirements of ASSE 1070. Unit shall be nickel plated with 1/2" MNPT connections, spindle to adjust outlet temperature and internal checks. Model #570 as manufactured by Lawler.
4. Furnish and install a Zurn series 1200 fixture carrier for wall hung lavatories.
5. Furnish and install ADA wrap on supplies and traps.

H. ADULT HEIGHT WASH FOUNTAIN - WF-1.

1. Unit shall be standard height, 34" to rim and ADA compliant, Bradley Express Lavatory System TLX Series, 3 station, Terreon Solid Surface with adaptive infrared touch free faucet;

    a. Basin: Terreon solid surface construction.
    b. Access Panel: Vandal-resistant fasteners.
    c. Strainer & Drain Assembly: 300 series stainless steel strainers, tailpiece, individual drain rough-in.
    d. Faucets: Chrome plated, 0.5 GPM, AC Power supply. S53-3100 Verge Faucet.
    e. Soap: Soap drilling only. Coordinate Soap system w/ Arch.
    f. Pre-assembled Vernatherm™ thermostatic mixing valve assembly complete with checks, stops, strainers and flexible stainless steel supply hoses.
    g. Color to be selected by Architect.

I. JUVENILE HEIGHT WASH FOUNTAIN - WF-2.

1. Unit shall be ADA compliant and mounted at Juvenile height. (Refer to Architect for mounting height) Bradley Express Lavatory System TLX Series, 2 station, Terreon Solid Surface with adaptive infrared touch free faucet;

    a. Basin: Terreon solid surface construction.
    b. Access Panel: Vandal-resistant fasteners.
    c. Strainer & Drain Assembly: 300 series stainless steel strainers, tailpiece, individual drain rough-in.
    d. Faucets: Chrome plated, 0.5 GPM, AC Power supply. S53-3100 Verge Faucet.
    e. Soap: Soap drilling only. Coordinate Soap system w/ Arch.
    f. Pre-assembled Vernatherm™ thermostatic mixing valve assembly complete with checks, stops, strainers and flexible stainless steel supply hoses.
    g. Color to be selected by Architect.

J. SEMI CIRCULAR WASH FOUNTAIN - WF-3.

1. Provide and install Acorn ADA Compliant Washfountain 3423-ADA-2-SO factory pre-assembled, with individual sectional control. Bowl shall be 14 gage stainless steel and shall have an integral backsplash. Sensor Operated spray heads shall be 18 gage stainless steel. Spray nozzles shall be vandal-resistant type with 0.5 GPM flow controls. Provide self-draining, air-circulating type soap/toiletry tray on top of sprayhead. On-Floor and Off-Floor Models shall have backsplash and housing framework anchored to wall. The wall shall be structurally reinforced to support the fixture. Standard base On-Floor Models shall have additional floor anchoring. Provide an ASSE 1070 compliant temperature/pressure balancing mixing valve with integral checks and strainers in H & C supply and field set water temperature at 105 degrees Fahrenheit. Units to conform to ANSI, UFAS and ADA requirements for accessibility.

K. JANITOR SINK - JS-1.

1. Bowl: 24x24x10" high white molded stone, floor mounted with 1" wide shoulders, stainless steel strainer; Model #MSB-2424 manufactured by Fiat.
2. Trim: ANSI A112.18.1; exposed wall type supply with cross lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges; 5 feet of 1/2" diameter plain end reinforced rubber hose, hose clamp, mop hanger; Model #897 manufactured by Chicago.

L. SHOWER, ADA - SH-1.

1. Basis-of-Design Product: Bradley Corporation Model No. HN200.

    a. Standards: ADA, ASME A112.18.1 and ASSE 1016.
    b. Shower Panel: 16 gauge type 304 stainless steel.
    c. Showerhead: Deluxe Showerhead with Ball Joint.
    d. Hand Held shower w/ on-off control, a 60" flexible hose.
    e. Diverter Valve.
    f. Flow Control: 1.5 gpm.
    g. Shower Valve: Hot/Tempered and Cold Supplies: HD pressure balancing valve.

h. Supply stops included.
i. Vandal resistant screws.
j. NOTE: Barrier-free seat, grab bars, and shower curtain shall be furnished by others.

M. SHOWER - SH-2.

1. Basis-of-Design Product: Bradley Corporation Model No. WS-1F.

a. Standards: ASME A112.18.1 and ASSE 1016.
b. Shower Panel: 18 gauge type 304 stainless steel.
c. Showerhead: Deluxe Showerhead w/ Ball Joint.
d. Flow Control: 1.5 GPM.
e. Shower Valve: Hot/Tempered and Cold Supplies: HD pressure balancing valve.
f. Supply Stops included.
g. Wall-Mount Soap Dish.
h. Vandal resistant screws.

N. SINGLE LEVEL WATER COOLER W/ BOTTLE FILLER - EWC-1.

1. Fountain: Unit shall provide 8.0 GPH of 50 degree F water at 90 degree F ambient and 80 degree F inlet water. Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 30-second shut-off timer. Unit shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing. Unit shall include antimicrobial protected plastic components to prevent mold and mildew. Cooler unit shall have push bar activation and water-efficient stream saver bubbler. Unit to include the WaterSentry plus filter with visual monitor. Bottle filling unit shall meet ADA guidelines for parallel approach. Cooler shall meet ADA guidelines for frontal of parallel approach. Model # LZS8WSLK as manufactured by Elkay.

O. BI-LEVEL WATER COOLER W/ BOTTLE FILLER - EWC-2.

1. Fountain: Unit shall provide 8.0 GPH of 50 degree F water at 90 degree F ambient and 80 degree F inlet water. Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 30-second shut-off timer. Unit shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing. Unit shall include antimicrobial protected plastic components to prevent mold and mildew. Cooler unit shall have push bar activation and water-efficient stream saver bubbler. Unit to include the WaterSentry plus filter with visual monitor. Bottle filling unit shall meet ADA guidelines for parallel approach. Cooler shall meet ADA guidelines for frontal of parallel approach. Model # LZSTL8WSLK as manufactured by Elkay.

P. BOTTLE FILLER - BF-1.

1. Bottle Filler: Unit shall provide 8.0 GPH of 50 degree F water at 90 degree F ambient and 80 degree F inlet water. Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 30-second shut-off timer. Unit shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing. Unit shall include antimicrobial protected plastic components to prevent mold and mildew. Bottle filling unit shall meet ADA guidelines for parallel approach. Model # EZWS8K as manufactured by Elkay.

Q. EMERGENCY EYE/FACE WASH - EW-1.

1. ANSI Z358.1; Wall mounted integrated Eye/Face wash unit and mixing valve, aerated sprays for eyewash comfort & innovative face pads for full face cleansing. Flip top dust caps, ABS Red plastic bowl, 1/2" NPT full flow stay-open ball valve. 3.0+ GPM @ 30-PSI, w/ emergency sign. Model # T2535 barrier free as manufactured by Stingray Systems. Unit shall be ASSE 1071 Approved.
2. Furnish to the owner one shower and eyewash test kit for each.

R. WASHING MACHINE OUTLET BOX - OB-1.

1. Furnish and install recessed, dual control single lever washing machine outlet box with 2" drain connection. Model # 82472 as manufactured by Guy Gray IPS Corporation.

S. ICE MAKER OUTLET BOX - OB-2.

1. Furnish and install recessed, white powder coated ice maker outlet box. Ice maker outlet box shall have a brass plated, quarter turn hammer arrester valve meeting Lead-Free requirements. Model # MIB1HAAB as manufactured by Guy Gray IPS Corporation.

T. SINGLE COMPARTMENT SINK - SK-1.

1. Bowl: ANSI A112.19.3; single compartment, 22x19x7-5/8" outside dimensions, 18 gauge thick, Type 302 stainless steel, self-rimming with undercoating, 3-1/2" crumb cup and chromed brass drain, ledgeback drilled for trim; Model #LR2219 manufactured by Elkay.
2. Trim: ANSI A112.18.1; chrome plated brass supply with swing gooseneck spout, Softflo aerator, and wrist blade handles. Model # 1100-GN8AE3-317AB as manufactured by Chicago. Furnish and install chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.

U. SINGLE COMPARTMENT SINK, ADA - SK-1A.

1. Bowl: ANSI A112.19.3; single compartment, 22x19x5-1/2" outside dimensions, 18 gauge thick, Type 302 stainless steel, self-rimming with undercoating, 3-1/2" crumb cup and chromed brass drain, ledgeback drilled for trim; Model #LRAD2219 manufactured by Elkay.
2. Trim: ANSI A112.18.1; chrome plated brass supply with swing gooseneck spout, Softflo aerator, and wrist blade handles. Model # 1100-GN8AE3-317AB as manufactured by Chicago. Furnish and install chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.
3. Furnish and install ADA wrap on supplies and traps where required.

V. DOUBLE COMPARTMENT SINK, FACS LAB - SK-2.

1. Bowl: ASME A112.19.3; double compartment 33x19x7-1/2" outside dimensions, 18 gauge thick, type 304 nickel bearing stainless steel, self-rimming with undercoating, 3-1/2" drain openings centered in bowls with chrome brass drain, ledgeback drilled for trim and sprayrinse; Model #LR3319 manufactured by Elkay.
2. Trim: Deck mounted 8" fixed centers hot and cold water supply with side spray. 8" L type swing spout, 1.5 GPM aerator. Model # 1102-E35ABCP as manufactured by

Chicago. Furnish and install chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.

W. DOUBLE COMPARTMENT SINK, FACS LAB - SK-2G.

1. Bowl: Same as SK-2.
2. Trim: Same as SK-2.
3. Garbage Disposal: Food Waste Disposer shall be InSinkErator Badger 5 continuous feed with 1/2 HP motor galvanized steel grinding elements with two stainless steel 360 degree swivel lugs. Self-service wrench.

X. DOUBLE COMPARTMENT SINK ADA, FACS LAB - SK-2A.

1. Bowl: ASME A112.19.3; double compartment 33x19x5-1/2" outside dimensions, 18 gauge thick, type 304 nickel bearing stainless steel, self-rimming with undercoating, 3-1/2" drain openings centered in bowls with chrome brass drain, ledgeback drilled for trim and sprayrinse; Model #LRAD3319 manufactured by Elkay.
2. Trim: Deck mounted 8" fixed centers hot and cold water supply with side spray. 8" L type swing spout, 1.5 GPM aerator. Model # 1102-E35ABCP as manufactured by Chicago. Furnish and install chrome plated 17 gauge brass P-trap with clean-out plug and arm with escutcheon.
3. Install shut off valve and line PVC pipe protectors and waste trap protectors at sink.
4. DISHWASHER - DW-1.

    a. Dishwasher shall be furnished and installed by others. Plumbing Contractor shall provide and connect ½" HW line with shut-off valve below sink SK-2A. Furnish and install dishwasher air-gap assembly and connect to sink SK-2A tailpiece.

Y. SINK ADA, FACS LAB - SK-3.

1. Basin: 18 gauge type 304 stainless steel wall hung single bowl lavatory sink kit. 19"x23"x9" sink dimension, 16"x13-1/2"x4" bowl dimensions. Furnish with hangers and stainless steel support brackets. Elkay model # WCL1923OSDC.
2. Trim: 8" center concealed deck mount faucet with gooseneck spout and 4" lever handles. 1.5 GPM flow rate. Elkay model # LKD232SBH5C. Perforated grid strainer and elbow Elkay model # LKAD174.
3. Furnish and install ADA wrap on supplies and traps where required.

Z. THREE COMPARTMENT SINK, FACS LAB - SK-4.

1. 14" deep standard series sink with 3 compartments, both left and right drainboards, 9" backsplash, 16 gauge, 304 stainless steel top and bowl, galvanized legs and adjustable feet, raised 1-1/2" rolled edge for additional strength. NSF Approved. 2-faucet drillings. 1-1/2" IPS S/S basket type strainers, Model # FC-3-1818-18RL as manufactured by Advance Tabco.
2. Trim: ANSI 112.18.1; (2-thus) 8" fixed center hot and cold supplies, washboard sink faucet, 12" type swing spout, full flow outlet, K-316-LU wristblade handles. Model # K-1 as manufactured by Advance Tabco. Furnish with 2" chrome plated 17-gauge brass P-trap with clean-out plug, and arm with escutcheon.

AA. PREP SINK, FACS LAB - SK-5.

1. 12" deep right-hand sink, left handed drainboard, 5" backsplash with 1" return, 16 gauge 304 stainless steel top and bowl, 18-gauge 430 stainless steel shelf, galvanized legs and adjustable feet, raised 1-5/8" rolled edge for additional strength. NSF Approved. 1-1/2" IPS S/S basket type strainers, Model # KMS-11B-306R-X as manufactured by Advance Tabco. Furnish w S/S basket strainer.
2. Trim: ANSI 112.18.1; 4" fixed center hot and cold supplies, deck mount sink faucet, 8" swing spout, full flow outlet, K-316-LU wristblade handles. Model # K-50 as manufactured by Advance Tabco. Furnish with 2" chrome plated 17-gauge brass P-trap with clean-out plug, and arm with escutcheon.

BB. UTILITY SINK, SHOP - SK-6.

1. Utility sink shall be single compartment, 21-1/2"x23"x13-1/2" molded stone, wall hung, with deck mouted swing arm, double handle wrist blade faucet. Sink to be Fiat # L-1, faucet to be Chicago # 895-317.

    a. Supplies: NPS 1/2 chrome-plated copper with loose key stops.
    b. Drain: Leak-proof, integrally molded in drain with stopper.

        1) Drain Piping: NPS 1-1/2 chrome-plated cast-brass trap, 0.045-inch- thick tubular brass waste to wall, and wall escutcheon.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 LEAD-FREE CERTIFICATION

A. The Mechanical Contractor must certify in writing that all equipment installed on this project is lead-free and will replace such fittings if determined that lead is contained in the equipment.

3.4 PLUMBING CAULKING AND SEALING

A. Use silicone seal between plumbing fixtures and wall, floor or cabinetry.

B. Provide a neat concave joint without excess material and/or overlapping. Clear or white.

3.5 HANDICAPPED LAVATORY INSULATION

A. Install shut off valve and supply line PVC pipe protectors and waste trap protectors at each exposed handicap lavatory.

3.6 INSPECTION

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Verify adjacent construction is ready to receive rough-in work of this Section.

3.7 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver, stops, reducers and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Mount fixtures to the following heights above finished floor. All handicapped fixtures shall be mounted to meet ADA Standards. Verify all mounting heights with architectural elevations. Any discrepancies shall be reported to Engineer/Architect before mounting fixture.

F. Mount handicapped flush valves for water closets below grab bar. See architectural elevations. Verify rough-in requirements with manufacturer's shop drawings, a minimum of 1-1/2" shall be provided from the top of flush valve to the bottom of grab bar.

3.8 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.9 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.10 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

3.12 SCHEDULES

A. Fixture Mounting Heights:

1. Water Closet:

a. Accessible Elem ADA: 15 inches to top of bowl rim.
b. Standard Adult: 15 inches to top of bowl rim.
c. Accessible Adult: 17 inches to top of seat.

2. Urinal:

a. Standard Adult: 22 inches to top of lip.
b. Accessible Adult: 17 inches to top of lip.

3. Lavatory:

a. Accessible Elem ADA: 30 inches to top of basin rim.
b. Accessible Adult: 34 inches to top of basin rim.

4. Wash fountains:

a. Verify mounting heights w/ Architectural Drawings.

5. Shower Heads:

a. 72 inches to bottom of head.

B. Verify all mounting elevations with architectural plans.

3.13 EQUIPMENT AND FIXTURES BY OTHERS

A. General - Mechanical Contractor shall provide a complete system of waste and vent and hot and cold water rough-in to all equipment by others. Mechanical Contractor shall connect up all water lines, drain lines and floor drains where shown to all fixtures and equipment by others.

B. Verify sizes, locations of drains and water supply inlet with supplier, also sizes and locations of waste and vent connections.

END OF SECTION

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SECTION 230500 - BASIC FIRE PROTECTION, PLUMBING AND HVAC REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Divisions 21, 22 and 23 Sections, in addition to Division 01 - General Requirements.

1.2 SCOPE OF WORK

A. The Mechanical Contract Installation shall include a complete plumbing installation of exterior and interior utilities for the building addition and remodeling. All piping, fixtures and equipment herein specified, mentioned or shown on Drawings, shall be furnished (except for such items that are specifically mentioned to be furnished by others) and installed in place, connected and ready for normal operation.

B. Plumbing installation shall include pipe, fittings, fixtures and specialties specified and necessary for a complete and acceptable system of waste, vent and water supply including necessary revisions to the existing systems. This includes sewer lines, connections to water supply and to all fixtures and outlets shown or specified, excavation, backfilling, protection of public, Owner's and adjoining property. Any minor details not covered or shown but necessary for successful operation shall be furnished without additional cost to Owner by this Contractor.

C. The Mechanical Contract shall include furnishing modifications to the existing sprinkler, fire protection system for the addition and remodeling and all other related work as called for under the Specifications and shown on Drawings.

D. The Mechanical Contract shall also include furnishing and installing a complete system of hot water and warm air heating, ventilating and air conditioning for the addition and remodeling with:

1. Hot water high efficiency condensing boilers.
2. Hydronic piping and pumping system and accessories.
3. Packaged HW/DX VAV rooftop units.
4. Packaged HW/DX Single zone variable volume rooftop units.
5. Exhaust and relief equipment.
6. Ductwork for air delivery systems with required accessories.
7. Terminal units and radiation for heating.
8. Air inlets, outlets and O.A. intakes for ventilation.
9. VAV Reheat boxes and reheat coils for zone control.
10. Building Automation System (BAS) extension.
11. All other related work as called for under Specifications and shown on Drawings.

1.3 WORK INCLUDED

A. The Mechanical Contract shall include all Work under the listed Sections of the Specifications Index and all related Mechanical Work as shown on the Drawings for the project.

B. The Mechanical Contractor shall be responsible for equipment and material access into the building and routing through the building including removal, enlargement and/or reinstallation of impediments such as door and frames, louvers and portions of walls, floors and roofs.

C. The Mechanical Contractor shall be responsible for any costs related to a change in equipment dimensions as it affects building access, code clearances, maintenance access clearances, coil removal space, tube removal space, existing piping, existing ductwork and existing electrical components.

D. A complete table of Mechanical Reference Symbols is shown on the Drawings.

1.4 WORK NOT INCLUDED

A. The following Work is not included as part of the Mechanical Contract.

1. Electrical Contractor shall furnish and install all power wiring, magnetic starters, disconnect switches, etc., except as called for to be included with the equipment and shall make all final connections to the equipment provided by the Mechanical Contractors.
2. Natural Gas Service to building. The Mechanical Contractor shall contact the Gas Utility Company include any applicable Gas Utility Company costs associated with new gas service to the new boiler room.

1.5 CODES, FEES AND LATERAL COSTS

A. The Mechanical Installation shall meet all applicable local, state and federal codes and standards.

B. All required permits necessary for a complete mechanical installation shall be paid for by The Mechanical Contractor(s).

C. The plumbing Work shall be installed in strict accordance with the state of Minnesota Plumbing Code. Any change from the Drawings and Specifications required by the State or City Plumbing Inspector shall be made by this Contractor at no additional cost to the owner.

D. Except in those municipalities which provide state-approved electrical inspection, all installation of electrical equipment wiring shall be inspected by the State Board of Electricity. Allowance shall be made in the bid and Contract for the cost of such inspection.

1. Fees for such inspection shall be charged in accordance with the rules and regulations of the State Board of Electricity. Evidence of payment of fees shall be provided by the Contractor with their Application for Payment.

E. Mechanical Contractor(s) shall be responsible to provide for all State or local inspector tests required by the current codes. Verify with the project inspector the tests, reports and witnessing that is required before construction begins.

1.6 CONTRACT TYPE

A. The Mechanical addition and remodeling installation to be made under Divisions 21, 22 and 23 is set up for Contract bidding as follows:

1. Combined or Individual Plumbing, Fire Protection Sprinkler, Heating, Ventilating and Air Conditioning Contracts as a prime bid to the Owner/Construction Manager.
2. See Division 01 for Contract breakdown and bid package requirements.

1.7 WORK SEQUENCE (SEE DIVISION 01)

A. Install Work in stages to accommodate Owner's occupancy requirements. During the construction period coordinate mechanical schedule and operations with Owner/Construction Manager.

1.8 FUTURE WORK

A. Provide for future Work under requirements of Division 01.

B. Refer to construction management bid descriptions and phasing plan.

1.9 ALTERNATES

A. Alternates quoted on Bid Forms shall be reviewed and accepted or rejected at the Owner's option. Accepted Alternate prices shall be identified in Owner-Contractor Agreement.

B. Coordinate related Work and modify surrounding Work as required.

C. See Division 01 for Alternate descriptions and bid forms.

1.10 REFERENCES

A. All equipment, piping, etc., shall be new (unless noted otherwise) and shall be installed to meet the approval of the following additional ordinances: ASME Rules for Pressure Tanks, National Board of Fire Underwriter's Rules, American Water-Works and the American Gas Association.

1.11 SUBMITTALS

A. Submit shop drawings under provisions of Division 01 and/or where noted in specific sections of the Specification.

B. Proposed Products List: Include information on products specified in the following Sections for Engineer’s review, approval and for inclusion in the Owner’s Manuals:

1. 210500 Common Work Results for Fire Suppression.
2. 211313 Wet-Pipe Sprinkler Systems.
3. 221100 Facility Water Distribution and Specialties.
4. 221126 Facility LP Gas Piping and Fuel Storage.

5. 221300 Facility Sanitary Sewerage and Specialties.
6. 221500 General Service Compressed Air System.
7. 223100 Water Treatment System.
8. 223400 Fuel-Fired Water Heaters.
9. 224000 Plumbing Fixtures.
10. 230516 Expansion Fittings, Loops and Flexible Connectors for HVAC Piping.
11. 230529 Hangers, Supports, Safety Rails and Firestopping for Plumbing, Fire Protection, HVAC Piping and Equipment.
12. 230553 Identification for HVAC, Plumbing Piping and Equipment.
13. 230700 HVAC and Plumbing Insulation.
14. 230915 Carbon Monoxide/Nitrogen Dioxide Sensing.
15. 230923 Direct Digital Control System for HVAC - Extension of Existing Building Automation System (BAS).
16. 230933 Variable Frequency Motor Controllers.
17. 230993 Sequence of Operation.
18. 232113 Hydronic Piping.
19. 23 214 HePEXa Hydronic Distribution Piping.
20. 232116 Hydronic Piping Specialties.
21. 232123 Hydronic Pumps.
22. 232126 Glycol System.
23. 232150 HVAC Water Treatment.
24. 233300 Air Duct Accessories.
25. 233327 Sound Attenuators and Duct Lagging.
26. 233332 Wood Dust Collection Systems.
27. 233337 Welding Fume Collection Systems.
28. 233355 Non-Metal Fabric Duct System.
29. 233405 HVAC Fans.
30. 233600 VAV - Air Terminal Units.
31. 233700 Air Outlets and Inlets.
32. 234000 HVAC Air Cleaning Devices.
33. 235120 High-Efficiency Boiler Chimneys.
34. 235122 High-Efficiency Stainless Steel Condensing Boiler.
35. 238103 Packaged Rooftop Air Conditioning Units.
36. 238200 Terminal Heating Units.

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal for each specification section.

D. Mark dimensions and values in units to match those specified.

E. Electronic Submittals:

1. Shop drawings shall be submitted electronically in a digital format (i.e., PDF document file), and arranged as described above and shall bear the contractors dated review stamp.
2. All shop drawings shall include a transmittal cover sheet from the contractor that shall be attached to the same shop drawing file so the Engineer or Construction Manager do not have to electronically merge files. If there are multiple transmittals involved due to construction management or sub-contracting, all of the transmittals for each specification section shall be attached within the same shop drawing file.
3. Multiple shop drawings in a book format with one transmittal shall not be acceptable as each specification section requires its own transmittal and review stamp.

F. NOTICE: Before release of the shop drawing is acceptable, the Contractor's stamp, initialed or signed, must be provided certifying their review of the submittal, verification of products, verification of field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and the Contract Documents. If shop drawings are not stamped by the Contractor and marked as "Reviewed", "Approved" or "Approved as Noted", they may not be processed by the Engineer. If the Engineer does review them in this instance, the contractor is still responsible for their detailed review of them and stamping them before release to their supplier.

G. It is the contractor's responsibility to provide submittals that are fully-compliant with the requirements of the construction documents. The engineer will review the equipment submittals for compliance with the requirements of the plans and specifications. After the submittals have been reviewed, they will be marked "Approved", "Approved as Noted" or "Rejected - Re-Submit". The engineer will make every effort to identify non-compliant equipment in the submittal process, but the engineer will not be responsible for any costs that may be required to correct non-compliant conditions (up to and including replacement of installed non-compliant equipment with the correct equipment), regardless of the fact that the submittal may be marked "Approved" or "Approved as Noted".

1.12 SYMBOLS AND ABBREVIATIONS

A. Refer to symbol sheets on drawings. Other symbols are in common usage, but if any uncertainty exists regarding any plan symbols or abbreviations, they shall be brought to the attention of the Engineer and he shall clarify same by issuing an addendum or clarification.

B. Where the phrase starts "Provide…," "provide" shall be construed to mean the same as "Furnish and install……".

1.13 APPROVED MANUFACTURERS

A. Throughout these specifications or addendums, manufactures and materials are listed as approved equal substitution. The approval applies only in so far as they comply with the requirements of the drawings and specification and is subject to final approval with submission of shop drawings.

B. Any extra costs of any changes in any trade's work, as a result of any substitutions, shall be borne by the CONTRACTOR making the substitutions.

1.14 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. If requested by the Engineer, provide a sketch or drawings showing proposed revisions to make the new work meet with actual Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer Owner/Architect before proceeding.

1.15 SEQUENCING AND SCHEDULING

A. Construct Work in sequence of stages or phases under provisions of Division 01.

1.16 PRE-CONSTRUCTION COORDINATION AND VERIFICATION

A. This Contractor shall coordinate his Work with other Contractors on this job. Any conflict which cannot be resolved shall be settled by the Architect/Engineer.

B. Field verification of scale dimensions on Drawings is directed since actual locations, distances and levels shall be governed by actual field conditions.

C. The Contractors shall check architectural, structural, plumbing, heating, ventilating and electrical drawings (and site conditions) to avert possible installation conflicts. If drastic changes from original Drawings are deemed as necessary to resolve such conflicts this Contractor shall notify the Architect/Engineer and secure written approval and agreement on necessary adjustments before the installation is started.

D. Discrepancies shown on different Drawings or between Drawings and actual field conditions or between Drawings and Specifications shall promptly be brought to the attention of the Architect/Engineer for a decision. Contractor shall not scale drawings for exact locations of equipment. (Verify final location.) All dimensions shall be taken from Architectural Drawings.

E. The Contractor shall consider and review existing site conditions and the complete set of documents including Architectural, Structural, Mechanical, Electrical, etc., (Drawings and Specifications) as his complete set of documents. He shall be responsible for all mechanical work shown or stated (to be by him), to include this Work in his bid and install such items even though they are not specifically shown or stated on the Mechanical Section of the Drawings and Specifications.

1.17 INTERPRETATIONS OF DOCUMENTS

A. Contractors shall promptly notify the Engineer of inconsistencies, errors and omissions that may be found in the Drawings and Specifications prior to bid date.

B. Questions regarding the bidding and requests for interpretation of the Drawings and Specifications shall be submitted to the Engineer in writing in sufficient time to be received prior to the date for receipt of bids.

C. Interpretation and correction of the Drawings and Specifications shall be made by addendum. Interpretations and corrections made by any other method shall not be binding on the Owner or the Engineer.

D. The drawings and Specifications are complementary to one another. This defines a relationship such that any item which is provided for in one document is to be considered as provided for in both sets of documents. Where conflicts exist between the Specifications and/or drawings, the more stringent requirement shall apply.

1.18 TEMPORARY COOLING DEHUMIDIFICATION AND VENTILATING FOR REMODELING AND NEW CONSTRUCTION WORK

A. The various types of air handling equipment and systems shall not be used for temporary heating, ventilation, dehumidification or cooling during the construction of this project without written permission of the Engineer.

B. When deemed acceptable by the Engineer, the air handling equipment and systems may be used provided that all return air duct and grille openings are protected by a filter with a 20% efficiency rating of MERV 6 or higher.

C. Filters in the air handling equipment shall be in place during all temporary heating, ventilating or cooling operation. When temporary operation is completed, the filters shall be replaced with new, specified units and an additional set of filters shall also be labeled and stored nearby for the first filter change per Specification Section 23 40 00.

D. If air handling equipment and systems are operated in deference to the restrictions, the Engineer may require that all affected ductwork, equipment and coils be internally cleaned, by the Mechanical Contractor, at no additional cost to the owner or Engineer.

E. All installed ductwork and air handling equipment openings shall be protected from intrusion of construction dust and dirt by using taped or securely fastened plastic protective covers. Leave protection in place until final connections are completed.

1.19 ACCESS DOORS

A. The Mechanical Contractors shall provide and install all necessary hinged access doors on finished walls, floors or ceilings to adjust and/or reset the mechanical systems behind these finished surfaces.

B. The Contractor shall familiarize themselves with the plans, wall, floor and ceiling finish schedules, details and fire ratings.

C. Provide fire-rated access doors on fire-rated surfaces.

1.20 CUTTING, PATCHING AND FIRESTOPPING

A. This Mechanical Contractor shall set all sleeves in construction for the mechanical equipment installation. Where cutting is required, it shall be done by this Contractor. All patching left after demolition and left by new cutting shall be done by the Mechanical Contractor unless noted otherwise due to size or type of finished surface patching that is required. Such locations, if any, shall be noted on the plans for the General Contractor's inclusion. Mechanical Contractor shall provide and install all fire- stopping materials as specified in Divisions 21, 22 and 23.

B. Cutting and patching of interior walls for HVAC demolition and installation shall be by the Mechanical Contractor unless noted otherwise. Cutting and patching exterior walls and roof for HVAC installation shall be by the General Contractor.

C. All penetrations of masonry wall by piping and round ducts shall be core drilled for neat appearance and minimal patching.

D. Lintels:

1. The installation of support lintels at existing masonry walls, brick faces or stone faces (where the openings are cut by the Mechanical Contractor) shall be the responsibility of

the Mechanical Contractor unless specifically noted or detailed otherwise on the Architectural or Structural drawings.

2. This work shall also include modifications to existing openings for piping and ductwork or equipment installations such as recessed cabinet unit heaters.

1.21 PROTECTION OF FINISHES

A. All contractors shall take the necessary precautions and provide all means necessary to protect the existing building finishes during construction. Any damage that occurs shall be repaired as required to match the pre-damage conditions at no additional cost to the owner. The contractors shall provide protective coverings as required when executing work that is likely to cause damage (i.e. pipe threading, painting, welding/cutting, core drilling, etc.) Contractor shall make the owner aware of any existing building finishes damage prior to executing work.

1.22 ELECTRICAL

A. Electrical Contractor shall furnish all motor starters and motor controls and provide all wiring for motor control operation, except if specified otherwise.

1.23 ADDITIONAL ELECTRICAL AND AUTOMATIC TEMPERATURE CONTROLS COSTS

A. If the Mechanical Contractor substitutes equipment that was an approved substitution before bidding, instead of the scheduled units, the Mechanical Contractor shall be responsible for any additional electrical and B.A.S. installation costs for this substitution regardless of whether the other equipment manufacturer was listed as equal in the Specification or was listed as an approved substitution after the Project was in the bidding process.

1.24 GUARANTEE / WARRANTY

A. The Contractor shall be responsible for the proper installation and performance of everything in their portion of the project and shall guarantee to remedy free of charge any defects in workmanship and materials that may appear to give rise to trouble of any kind for a period of one year from the date of Substantial Completion of the work (unless noted otherwise as a longer warranty period in an individual specification section).

1.25 OWNER'S MANUALS AND OPERATING INSTRUCTIONS

A. Under this Contract the Mechanical Contractor shall furnish the Owner with two 3-ring binders or digital file(s) of all pertinent systems information and related documents. Submit these documents to the Engineer for their review. The documents shall contain the following items:

1. All Shop drawings of major equipment, complete with Engineer’s and Mechanical Contractor’s approval stamps.
2. Installation and Operating Instructions for all major equipment.
3. Boiler start-up report and combustion test report.
4. Boiler second start-up during heating season with follow-up reports and a list of personnel that was present.
5. Packaged RTU start-up reports.

6. Document RTU training method, date of training and list of personnel that was present.
7. VFD start-up report for each VFD unit. Document when training was provided, the information that was shared, who provided the training and who was present.
8. Submit certification reports to Engineer showing that all required testing for the project, including water piping, sewer/vent piping, natural gas piping and storm piping.
9. Water heater start-up report and combustion test report.
10. Maintenance instructions for all major equipment.
11. Wiring diagrams for all equipment.
12. Building Automation System points and sequence of operation verification report and compliance statement.
13. Final Test and Balance Report.
14. Final Glycol Analysis for hot water systems.

B. Using the Owner's manuals, the Mechanical Contractor shall instruct the Owner/Owner's Representative on the proper operation of all equipment installed as part of this Contract. These instructions shall include, but not be limited to preventative maintenance, safety instructions and normal operating procedures.

C. After the Owner has been instructed, the Contractor shall submit a letter to the Mechanical Engineer documenting that the information was given to the Owner and that the owner/owner's representative signed off on this part of the Contract.

1.26 EQUIPMENT START-UP AND TRAINING

A. The Mechanical Contractor shall be responsible for providing both a heating season start-up and cooling season start-up of heating, cooling, humidification, BAS and dehumidification equipment including:

1. Training the owner in all methods needed for winterization of equipment, coils, drain down, etc.
2. Training the owner regarding lubrication of all components and establishing a preventative maintenance schedule.
3. Training the Owner in regards to BAS programming modifications and seasonal changes.
4. Training the Owner in proper operation and maintenance of all seasonal Equipment using the O & M manuals.
5. Observing and establishing a recommended filter changing schedule or establishing a static pressure point for change based on pressure differential measuring.

1.27 DEMOLITION

A. If, (in the process or removing piping, equipment, wiring or duct work) the support of other apparatus is affected, such supports shall be rearranged or additional supports added as required to meet code. All such work shall be included in the bid.

B. Any piping, equipment, wiring or duct that is inadvertently removed or damaged during demolition shall be replaced in the same or better condition than the existing installation.

C. Any unused supports that remain after demolition and after new equipment, wiring, piping or ductwork locations are established shall be removed. Any resulting damage to walls, floor or ceilings shall be patched to match existing conditions.

D. Demolition of mechanical equipment may require the removal and reinstallation of other existing equipment or building elements including mechanical (ductwork, piping, supports, etc.), electrical (conduits, wiring, lighting, etc.), or general construction building items (walls, roofs, door frames, etc.) in order to gain adequate access to the equipment to be demolished. The plans may or may not include reference to these items, however all costs associated with gaining access to the items to be demolished and restoration of items that need to remain shall be the responsibility of the contractor performing the demolition work. Contractor shall field verify existing conditions prior to bidding.

E. If ceiling removal is necessary to facilitate the removal of existing equipment and/or the installation of new equipment, the ceiling removal shall be the responsibility of the mechanical contractor unless the ceiling removal is noted to be provided by others. The repair or replacement of the ceiling when the work is complete shall also be the responsibility of the mechanical contractor unless ceiling replacement is specifically noted to be provided by others.

1.28 EQUIPMENT ACCESS

A. The installing Contractor shall be responsible for determining means and methods for gaining access to building spaces for the purpose of removing equipment and/or installing new equipment. The plans may or may not include information related to equipment access. In the process of removing old equipment and/or installing new equipment, it may be necessary to remove existing mechanical (ductwork, piping, supports, etc.), electrical (conduits, wiring, lighting, etc.), or general construction building elements (walls, roofs, door frames, etc.) in order to gain adequate access to the spaces. All costs associated with this work shall be the Mechanical Contractor's responsibility and shall be included in the Mechanical Bid. The Owner shall not be responsible for any additional costs associated with equipment access.

B. The installing Contractor shall coordinate adequate space for maintenance personnel to work on the installed equipment regardless of location. This is a critical issue that needs to be discussed and coordinated early in the Contractor coordination meetings.

C. Equipment installed above a ceiling shall have ceiling tile or ceiling access panels coordinated such that they provide best possible arrangement for ladder access and full shoulder width access for maintenance personnel. If necessary, the ceiling grid may need to be adjusted to a non-symmetrical centering in the room involved.

D. All equipment (requiring servicing) that is located above a ceiling shall be no more than 20" above the ceiling. Coordinate with all other trades to provide for this requirement.

1.29 ASBESTOS INSULATION AND/OR LEAD CONTAMINATION

A. Where insulation on existing piping or equipment being removed under this Contract contains asbestos products or has lead contamination, the Contractor shall stop all Work and notify the Owner/Architect/Engineer and not proceed with any further Work until the asbestos has been removed and/or encapsulated by others under a separate Contract between the Owner and the asbestos removal company. If lead is encountered, the Owner shall have the quantities and hazard identified and shall inform the Contractor of the necessary steps required to eliminate the hazard.

1.30 EQUIPMENT REMOVAL

A. The Mechanical Contractor shall remove all unused piping, plumbing fixtures, mechanical equipment and ductwork as noted and/or where existing is not to be re-used for the Project.

B. The Owner shall have the right of first refusal for all removed equipment. If refused, the Mechanical Contractor shall be responsible for disposal.

C. When removed equipment is to be re-installed as part of the project, the Contractor that removes the equipment shall be responsible for storage and protection. Any damage or loss of equipment prior to re-installation shall be the responsibility of this Contractor to provide replacement.

1.31 WINTERIZATION

A. Some equipment or systems (i.e., piping, coils, etc.) may require special seasonal shutdown or winterization to protect the systems from damage due to freezing. The installing Contractor shall be responsible for all necessary material and labor required to winterize the equipment to provide protection from freezing for the first winter season after the equipment has been installed. When completing the winterization procedures, the Contractor shall be responsible for training the Owner on the proper methods for winterization. Documentation of the training signed by the owner, along with type-written procedures for future reference, shall be included in the O&M manual.

B. The installing Contractor shall be responsible for any labor and material costs associated with equipment repair or replacement due to damage related to equipment that has not been properly winterized.

1.32 PRODUCT SUBSTITUTIONS

A. The details and arrangements shown on the plans may be specific to the products included on the product schedule (i.e. RTU's, etc.) Utilizing products by other approved manufacturers (approved equals) may result in the requirement for modifications to the equipment arrangement or installation materials including different piping configurations, valving, venting, clearances, access, etc. It shall be the Contractor's responsibility to identify any necessary changes. Any modifications that are required to provide a fully functioning system that meets the project requirements and complies with the equipment manufacturer's installation recommendations shall be provided as part of the project at no additional cost to the owner.

B. If changes are required, the Contractor shall be responsible for providing a description and drawing that shows the necessary modifications for Engineer review prior to equipment installation. This drawing shall be submitted with the shop drawings for the equipment that is impacted and shall be drawn to the same scale as the original plans where the involved equipment is shown.

1.33 COMMISSIONING

A. This project will be subject to commissioning activities as detailed in a separate agreement directly with the Owner. The Mechanical Contractors shall provide assistance to the

Commissioning Authority as detailed in the specification to commission the mechanical systems that are provided and installed as part of their work scope.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 230516 - EXPANSION FITTINGS, LOOPS AND FLEXIBLE CONNECTORS FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.
2. Expansion joints.
3. Expansion compensators.
4. Pipe alignment guides.
5. Pipe anchors.

B. Related Sections:

1. Section 23029 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for piping hangers and supports.
2. Section 232113 - Hydronic Piping: Product and installation requirements for piping used in hydronic heating and cooling systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Service Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.3 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:

1. Installation Temperature: 50 °F.
2. Hot Water Heating System Temperature: 160 °F.
3. Safety Factor: 30 percent.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Manufacturer's Installation Instructions: Submit special procedures.

D. Welders' Certificate: Include welder's certification of compliance with ASME Section IX and AWS D1.1.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 and ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with State of Minnesota standard.

C. Maintain one copy of each document on site.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Manufacturers:

1. ADSCO.
2. Advanced Thermal.
3. Metra-Flex.
4. Minnesota Flexible.
5. Flexonics.
6. Victaulic.
7. Gustin Bacon.
8. Twin City Hose.

B. Steel Piping:

1. Inner Hose: Stainless Steel or Bronze.
2. Exterior Sleeve: Single braided stainless steel or bronze.
3. Pressure Rating: 125 psig WSP and 450°F.
4. Joint: Flanged, Threaded with Union or Welded dependent on pipe size and location.
5. Size: Use pipe-sized units.
6. Maximum offset: 3/4 inch on each side of installed center line.

C. Copper Piping:

1. Inner Hose: Bronze.
2. Exterior Sleeve: Braided bronze.
3. Pressure Rating: 125 psig WSP and 450°F.
4. Joint: Threaded with Union or Soldered.
5. Size: Use pipe sized units.
6. Maximum offset: 3/4 inch on each side of installed center line.

2.2 EXPANSION JOINTS

A. Stainless Steel “U” configuration loop. Metraflex “Metraloop” is basis of design. The loop shall consist of two flexible sections of stainless steel braid with two 90° elbows and one 180° return elbow. Units shall be provided with either a flanged or grooved connection and shall be rated for 150 psig.

B. Two-ply Bronze Bellows Type:

1. Construction: Bronze with anti-torque device, limit stops, internal guides.
2. Pressure Rating: 125 psig WSP and 400°F.
3. Maximum Compression: 1-3/4 inch.
4. Maximum Extension: 1/4 inch.
5. Joint: Soldered.
6. Size: Use pipe sized units.
7. Application: Copper piping.

C. Low Pressure Compensators with two-ply Bronze Bellows:

1. Working Pressure: 75 psig.
2. Maximum Temperatures: 250°F.
3. Maximum Compression: 1/2 inch.
4. Maximum Extension: 5/32 inch.
5. Joint: Soldered.
6. Size: Use pipe sized units.
7. Application: Copper or steel piping 2 inch and smaller.

2.3 ACCESSORIES

A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for thickness of insulation, and minimum 3 inch travel.

2.4 PIPE LOOPS, OFFSETS AND SWING JOINTS

A. Use of piping and fittings for expansion compensation is approved when pipe guides and anchors are used in conjunction with the manufacturer's recommended lengths of offset, grade separation and anchorage methods are utilized.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with ASME B31.5 and ASME B31.9.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 230529 for pipe hanger installation requirements.

F. Provide expansion loops as indicated on Drawings and as necessary during construction as field conditions dictate.

END OF SECTION

SECTION 230529 - HANGERS, SUPPORTS, SAFETY RAILS AND FIRESTOPPING FOR PLUMBING, FIRE PROTECTION, HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Flashing.
4. Sleeves.
5. Mechanical sleeve seals.
6. Formed steel channel. (Unistrut).
7. Firestopping.
8. Firestopping accessories.
9. Equipment bases and supports.
10. Housekeeping pads.
11. Inserts.
12. Roof mounted equipment curbs.
13. Roof mounted piping, foam supports.
14. Exterior HVAC pipe and duct support.
15. Underground wall penetrations.

B. Related Sections:

1. Division 03 - Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
2. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
4. Division 21 - Fire Suppression.
5. Section 221100 - Water Distribution and Specialties: Execution requirements for placement of hangers and supports and underground link seal.
6. Section 221123 - Facility Natural Gas Piping: Execution requirements for placement of hangers and supports and underground link seal specified by this section.
7. Section 232113 - Hydronic Piping: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.5 - Refrigeration Piping.
2. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263 and UL 1479 to achieve fire ratings of adjacent construction in accordance with FM and UL Design Numbers.

B. Surface Burning: ASTM E84 and UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to FM and UL for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pipe hanger types and sizes. Indicate fire-stopping products and intended use and locations.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

E. Engineering Judgments: For conditions not covered by FM or UL listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

D. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.8 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's dentification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60°F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS - PIPE HANGERS AND SUPPORTS

A. Hangers - B-Line.

B. Riser Clamps - B-Line.

C. Expansion Anchors - Hilti.

D. Power Driven Fasteners - Hilti.

E. Anvil International (Hangers and Clamps).

F. Tolco/Nibco.

G. Pipe Hangers and Devices "P.H. & D.".

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch split ring or clevis of malleable iron with adjustable swivel, Clevis.

B. Hangers for Pipe Sizes 2 to 4 Inches and Cold Pipe Sizes 6 Inches and Over: Carbon steel, adjustable.

C. Hangers for Hot Pipe Sizes 5 Inches and Over: Adjustable steel yoke, cast iron roll hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 Inches: Knee brace and clevis hanger.

F. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.

G. Vertical Support: Steel riser clamp.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

I. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.

J. Shields for Insulated Piping 2-1/2 Inches and Larger: Hard block non-conducting saddles in 90 degree segments, 12 inch minimum length, support block thickness same as shall be the same as insulation thickness.

K. All hydronic and cold water plumbing water piping shall have hangers sized to accommodate pipe insulation so the pipe does not come in contact with the hanger.

2.3 HANGER RODS

A. Steel Hanger Rods: Threaded at both ends, threaded one end or continuous threaded.

2.4 FLASHING

A. Metal Flashing: 26 gauge thick galvanized steel.

B. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

C. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.5 SLEEVES

A. Sleeves for pipes through Non-fire Rated Floors: Form with 20 gauge galvanized steel or Schedule 40 PVC.

B. Sleeves for pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 20 gauge galvanized steel or Schedule 40 PVC.

C. Sleeves for pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Sleeves shall comply with firestopping manufacturer's published requirements.

D. Sleeves for Round Ductwork: Form with galvanized steel.

E. Sleeves for Rectangular Ductwork: Form with galvanized steel or wood. (Remove wood blocking after concrete has set.).

F. Stuffing Insulation: Glass fiber type, non-combustible.

G. Caulk: Silicone sealant of quality specified in Division 07.

H. Pre-fabricated wall sleeves by Thunderline or equal.

I. Wall and floor seals by Pyropal or equal are an acceptable option.

2.6 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.
7. Metacaulk.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single or multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single or multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Mineral fiberboard.
2. Sheet metal.
3. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates orceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.8 HOUSEKEEPING PADS

A. Mechanical Contractor provide 3-1/2” tall concrete housekeeping pad under equipment in mechanical rooms and under outdoor equipment, such as condensing units.

B. Refer to PART 3 schedule and plan details.

2.9 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.10 EXTERIOR HVAC PIPE AND DUCT SUPPORT

A. Manufacturer.

1. PHP Systems Design.
2. Erico.
3. MIPO Industries.

B. Base:

1. PHP Systems Design with a18"x18"x3" or 18" round x 3" base weighing 10.5 or 7.0 pounds. Injection molded HDPE with UV inhibitors and antioxidants.
2. Erico Pyramid “Caddy” with 8”x19”x 4” high base weighing 5 pounds.
3. Injection molded HDPE with UV inhibitors.
4. MIRO Industries with 16”x18”x3” high base made with polycarbonate.

C. Framing: 1-5/8" or 1-7/8" 12 gauge struts as required by load and as recommended by manufacturer. Struts are roll-formed, three-sided tubular shape with 9-1/16" holes at 1-7/8" centers on all three sides.

D. Finish: Hot dipped G90 galvanized.

E. Hardware: Hot dipped galvanized.

F. Supports designed for use on flat roofs and sloped roofs up to 2/12 pitch.

G. PHP Model #PP-10 with channel for piping up to 1-1/2”. PHP Model #PSE-2-2 for piping 2” and larger utilizing clevis hanger and saddles.

2.11 EQUIPMENT CURBS

A. Mechanical Contractor shall provide factory-fabricated and insulated curbs for roof-mounted equipment and piping. Refer to Plan Sheets for curb details.

B. General Trades shall install the curb and provide all flashing and sealing that is required.

C. Refer to Section 23 37 00 for additional requirements relating to curb perimeter insulation and insulation inside the curb needed to meet model energy code R-12 requirements. Additional insulation inside the curb shall be provided and installed by the Mechanical Contractor.

2.12 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping through sleeve.

B. Design hangers with disengagement of supported pipe.

C. Provide copper plated hangers and supports for copper hot water piping.

2.13 FOAM BLOCK ROOF SUPPORTS FOR PIPE

A. “Pipe Pier” support system constructed of closed-cell polyethylene foam with Michigan strut adhered and recessed into 6” tall, 4” wide and 10-1/2" long insulation block by “Miro Ind., Inc.”.

B. Polycarbonate roller similar to Miro Ind., Inc. Model #R-3, R-4 and R-5.

C. E-Z sleeper interlocking UV stabilized polypropylene support rail with pipe guide/clamp.

D. Products manufactured by C-PORT and E-Z SLEEPER ROOFTOP BLOX shall be considered as equal.

2.14 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials as necessary to arrest liquid material leakage.

3.3 INSERTS

A. Provide inserts for placement in concrete form work.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

E. Where inserts are omitted, drill through concrete from below and provide thru-bolt with recessed square steel plate and nut into and grouted flush with slab.

3.4 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

MAXIMUM HANGER SPACING FEET			
PIPE SIZE	STEEL	COPPER	HANGER DIAMETER
1/2" to 3/4"	6	5	3/8"
1" - 1-1/2"	6	3	3/8"
2"	7	7	3/8"
2-1/2"	10	8	1/2"
3"	10	10	1/2"
4"	10	10	5/8"
6"	10	10	3/4"
8"-12"	12	10	1"

MAXIMUM HANGER SPACING FEET		
SIZE / MATERIAL	SPACING	HANGER DIAMETER
PVC (ALL SIZES)	2'-8"	3/8"
2" - 8" CAST IRON	5'-0" AND AT JOINTS	5/8"

1. If local Code is more stringent, install per local Code requirements.
2. PEXa piping (2” and smaller) that is installed inside the specified galvanized support channel shall use the same spacing and hanger requirements as copper piping of that same size.

B. Install hangers to provide minimum 1/2 inch space between finished insulation covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each joint, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Use of side clamps to hang piping 1-1/2" and smaller from side of bar joists is allowed. Clamp shall be located within 3" of welded panel point.

J. Do not use side clamps to hang support rods from the side of bar joists for piping 2" and larger. Hang from the center of a bar joist with a threaded rod in the center of the two joist angles within 3” of welded panel point.

K. The use of supports connected to steel decking shall be limited to piping 1" and smaller and to ductwork that is 14" diameter or smaller and equivalent rectangular duct. Equipment shall not be suspended from roof deck hangers.

3.5 HOUSEKEEPING BASES AND SUPPORTS

A. Mechanical Contractor shall provide templates, anchor bolts, and accessories for mounting and anchoring equipment to housekeeping pads. Mechanical contractor shall provide and install the concrete housekeeping pads.

B. Construct support of steel members. Brace and fasten with flanges bolted to structure.

C. Provide rigid anchors for pipes after vibration isolation components are installed.

D. Pads shall project minimum of 3-1/2” above floor. Mechanical Contractor shall install concrete housekeeping with top at 3-1/2” above finished floor. Concrete pads shall be installed under following equipment:

1. Boilers.
2. Base-mounted pumps.
3. Expansion tanks.
4. Water heater systems.
5. Water softener systems.

E. Mechanical Contractor shall locate all roof openings for the General Trades Contractor which shall install curbs and rails along with any support steel required for the steel roof decking.

1. Powered Ventilators.
2. Packaged RTU’s.
3. Roof Reliefs.
4. Large Goosenecks.
5. Boiler Stacks.

F. Verify depth of pad required with Structural Engineer for large equipment such as boilers and chillers.

G. Verify depth of blocks or steel supports required at floor for deep seal condensate trap and piping pitch to floor drain or janitor sink.

H. Verify height requirement from ceiling suspended air handling equipment condensate drain outlet to the lay-in ceilings and provide for deep seal trap and piping pitch space to discharge point.

I. Properly anchor all equipment to equipment bases and supports (i.e. floor slab, roof curb roof rail, etc.). When installing equipment on a building roof, ensure that adequate anchoring is provided to prevent equipment from blowing off support bases due to high wind conditions.

3.6 FLASHING

A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash and seal.

C. Fasten floor drain flashing to drain clamp device.

D. Seal floor, shower and mop sink drains watertight to adjacent materials.

3.7 SLEEVES

A. Set sleeves in position in form work. Provide re-enforcing around sleeves.

B. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation or fire stopping (depending upon assembly rating) and seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Install chrome plated steel escutcheons at finished surfaces. Use plastic escutcheons in damp areas of toilet/showers.

3.8 FOAM ROOF SUPPORTS FOR PIPE

A. Install “Pipe Piers” at spacing required by pipe weight and deflection. Wood blocking is not an acceptable substitute.

B. On built-up roof systems the support bearing area shall be “spudded” before duct or piping support placement to minimize damage potential from rocks compressed into the built-up membrane system.

3.9 HANGER AND SUPPORT PAINTING

A. None.

3.10 STRUCTURAL PENETRATIONS

A. Obtain permission from Architect or Structural Engineer before drilling or cutting structural members and reinforced concrete.

3.11 EXTERIOR PIPE AND DUCT SUPPORTS

A. Install per manufacturer's instructions based on material weights, sizes and wind exposure.

B. Provide uplift bar for high wind areas.

C. Install roofing membrane pads under each foot per manufacturer's instructions.

D. Verify spacing requirements with manufacturer.

E. Install supports level, both vertically and horizontally.

F. Distribute weight of ducts and pipes evenly throughout the system by proper support spacing.

G. Refer to plan details for supports and for coordination of roof connection or roof protection.

3.12 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness with uniform density and texture to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

F. Place intumescent coating in sufficient coats to achieve rating required.

G. Fire Rated Surface:

1. Seal opening at floor, wall and ceiling as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where conduit or wire-way penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

H. Non-Rated Surfaces:

1. Seal opening through non-fire rated partition, floor, ceiling, and roof opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
c. Install type of firestopping material recommended by manufacturer.

2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3.13 DUCT HANGERS AND SUPPORTS

A. Refer to SMACNA standards for recognized methods of support, hanger strength and spacing.

B. Use of side clamps to hang ductwork from side of bar joists shall be limited to 50 lbs. at each panel point. Clamps shall be located within 3 inches of welded panel point.

3.14 ROOF CURBS

A. General Trades Contractor shall install the curbs with the bottom of the curb a maximum of 3 inches below adjacent roofing surface by use of extra blocking. Flexible sheet-flash and counter-flash with sheet metal; shall provide watertight seal. Refer to installation details to ensure outside air intake clearance requirement above finish roof surface. Attach blocking to the roof deck and then curb to the blocking. Provide additional blocking as required for outside air intake clearance above roof and projected snow depth.

1. Refer to plan schedules and details for any curbs or rails that are required to be taller, such as packaged RTU’s, Intake Penthouses, roof mounted AHU’s, etc.

3.15 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.16 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.17 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 230553 - IDENTIFICATION FOR HVAC, PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Ceiling tacks.
5. Labels.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawing Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures and installation.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Brady Markers.
5. MSI - Marking Services, Inc.
6. EMED, Inc.
7. Brimar Industries.

2.2 TAGS

A. Plastic Tags:

1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location, plastic laminated.

2.3 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Tape Pipe Markers:

1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Wrap arrows on-a-roll pressure sensitive tape completely around the pipe label overlapping itself and the end of the pipe marker by 1/2 inch.

2.4 CEILING MARKERS

A. Description: 1/2 inch diameter color-coded sticky back dots.

B. Ceiling Grid color code as follows:

1. VAV boxes shall be labeled with a clear tape and 3/8" tall black letters.
2. Heating valves and reheat coils shall be identified with a 1/2" diameter red dot.
3. Domestic valves shall be identified with a 1/2" diameter blue dot.
4. Fire dampers and combination smoke/fire dampers shall be identified with a 1/2" diameter orange dot.
5. All other devices requiring service shall be marked with a yellow dot on the ceiling grid.

2.5 EQUIPMENT NAMEPLATES AND LABELS

A. Indoor type description: Engraved phenolic, size 4.0 inch wide x 2 inch tall, adhesive backed with 5/8” high printed identification. Yellow label with black lettering.

B. Outdoor type description: 0.020” thick aluminum, size 4.0 inch wide x 2 inch tall with two mounting holes or optional adhesive. Red label with 5/8” tall engraved aluminum lettering and symbols.

PART 3 EXECUTION

3.1 PREPARATION

A. De-grease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Equipment Nameplates: Install with corrosive-resistant mechanical fasteners, or adhesive.

1. Install outdoor equipment tags on north or shadiest side of equipment to minimize damage from sun exposure.

B. Tags: Install plastic or stamped type with corrosive-resistant chain.

C. Pipe Markers: Install in accordance with manufacturer's instructions.

D. Equipment: Identify pumps, RTUs, PRV’s, boilers, make-up air units and water treatment devices with plastic nameplates if equipment is inside and aluminum nameplates for exterior equipment. Small devices, such as in-line pumps, may be identified with tags.

E. Provide identification tags on the bottom of VAV boxes. Tag location shall be readily visible after removal of ceiling tile.

F. Controls: Identify control panels and major control components outside panels with plastic nameplates.

G. Valves: Identify valves in main and branch piping with tags indicating a valve number and fluid type being circulated.

H. Piping: Identify piping, concealed or exposed, with pipe markers.

I. Provide identification tag on Glycol/Water Pre-mix connections, Note shall state; “Pre-Mix Glycol/Water Solution only, No Potable Water Connections Allowed.”.

3.3 VALVE CHART AND SCHEDULE

A. Provide two valve charts and schedules framed under clear plastic shield. Chart shall cross reference the valve number, type, manufacturer, size and system served and valve location. Turn over to Owner.

3.4 CEILING IDENTIFICATION MARKERS

A. Install marking stickers on ceiling grids at points over which mechanical items requiring service or adjustment are located.

B. Familiarize the Owner's maintenance personnel with the location and function of the markers.

3.5 PIPE MARKING

A. Identify piping, concealed above accessible ceilings with pipe markers or color coded banding. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 40 feet on straight runs including risers and drops, adjacent to each valve, at each side of penetration of structure or enclosure and at each obstruction.

1. Provide a marker every twenty feet of piping in Mechanical Rooms and at all equipment connections.

B. All exposed piping both covered and uncovered shall be designated by color code in accordance with the following:

1. Coding shall be accomplished by self-adhesive pipe markers running parallel to pipe axis. Similar to Seaton "Opti-Code" pipe markers 8" long with 3/4" high letters up to 2-3/8" OD and 12" long with 1-1/4" high letters up to 7-7/8" OD. (8" long color field).
2. At each end of the marker, directional flow arrows shall completely encircle the pipe/or pipe covering. Banding shall be similar to Seaton arrows on-a-roll tape, two inch wide band. Overlap marker and arrow tape.

C. The standard piping color code is as follows:

Color	Opti-Code No.	Legend Function
Yellow/Black	M6850	Heating Water Heating Supply
Yellow/Black	M6849	Heating Water Heating Return
Green/White	M4208	Domestic Cold Water
Green/White	M4208	Hard Domestic Cold Water
Yellow/Black	M4267	Domestic Hot Water
Yellow/Black	M8146	Dom. Hot Wtr Return (Recirc.)
Yellow/Black	M4159	Natural Gas Piping
Yellow/Black	M4160	Gas Regulator Vent Piping
Green/White	M4222	Rain Water Leader
Red/White	M4289	Sprinkler-Fire (In Mech Rms Only)
Blue/White	24004	Compressed Air or other markers from ANSI/OSHA standard list.

END OF SECTION

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SECTION 230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, adjusting and balancing of air systems.
2. Testing, adjusting and balancing of hydronic systems.
3. Measurement of final operating condition of HVAC systems.

B. Related Sections:

1. Section 230923 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.
2. Section 230993 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.2 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms or NEBB Report forms. Submit data in S.I. units.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty or Copy of NEBB Certificate of Conformance Certification.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flow measuring stations and balancing valves.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Maintain one copy of each document on site.

C. Prior to commencing Work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

A. Approved Agencies.

1. Mechanical Test and Balance (AABC).
2. Test and Balance Associates, Inc. (Minneapolis).
3. Systems Mgmt. and Balancing - Center City, MN (AABC).
4. Design Control, Inc. - Fargo, ND (AABC).
5. Balancing Professionals Inc., Sioux Falls, SD (NEBB).
6. Air Systems Engineering - St. Louis Park.
7. Bal-Tech - St. Louis Park (NEBB).
8. TAB System, Inc. - Sioux Falls, SD (NEBB).
9. Flow Dynamic Balancing - Minneapolis (NEBB) - Sioux Falls, SD (NEBB).

B. Perform Work under supervision of AABC Certified Test and Balance or NEBB Certified Testing, Balancing and Adjusting registered professional engineer experienced in performance of this Work.

C. The Balancing Agency shall be an independent firm hired by the Mechanical Contractor and shall not be part of the Mechanical Contractor's corporation.

1.7 PRE-BALANCING MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum of one 85-95% progress inspection and meeting two week(s) prior to commencing work of this section.

1.8 SEQUENCING

A. Division 01 - Summary: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.9 SCHEDULING

A. Division 01 - Administrative Requirements: Coordination and project conditions.

1.10 RE-BALANCING

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.

14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design to space.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

1. It shall be the Balancing Company's responsibility to change sheaves and/or drives as necessary on up to 25 percent of the equipment installed.

B. Make air quantity measurements in main ducts by pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops and total pressure across fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air and exhaust dampers to check leakage.

J. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated Venturi tube fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature and pressure difference across various heat transfer elements in system.

C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting and Balancing:

1. Plumbing Pumps.
2. HVAC Pumps.
3. Packaged Fire Tube Condensing Boilers.

4. Packaged Roof Top Heating/Cooling Units.
5. Terminal Heat Transfer Units.
6. Exhaust Fans.
7. Relief Fans.
8. Air Filters.
9. Air Terminal Units.
10. Air Inlets and Outlets.

B. Report Forms.

1. Title Page:

    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Project Architect.
    g. Project Engineer.
    h. Project Contractor.
    i. Project altitude.
    j. Report date.

2. Summary Comments:

    a. Design versus final performance.
    b. Notable characteristics of system.
    c. Description of systems operation sequence.
    d. Summary of outdoor and exhaust flows to indicate building pressurization.
    e. Nomenclature used throughout report.
    f. Test conditions.

3. Instrument List:

    a. Instrument.
    b. Manufacturer.
    c. Model number.
    d. Serial number.
    e. Range.
    f. Calibration date.

4. Electric Motors:

    a. Manufacturer.
    b. Model/Frame.
    c. HP/BHP and kW.
    d. Phase, voltage, amperage; nameplate, actual, no load.
    e. RPM.
    f. Service factor.
    g. Starter size, rating, heater elements.
    h. Sheave Make/Size/Bore.

5. V-Belt Drive:

    a. Identification/location.
    b. Required driven RPM.
    c. Driven sheave, diameter and RPM.
    d. Belt, size and quantity.
    e. Motor sheave diameter and RPM.
    f. Center to center distance, maximum, minimum, and actual.

6. Pump Data:

    a. Identification/number.
    b. Manufacturer.
    c. Size/model.
    d. Impeller.
    e. Service.
    f. Design flow rate, pressure drop, BHP and kW.
    g. Actual flow rate, pressure drop, BHP and kW.
    h. Discharge pressure.
    i. Suction pressure.
    j. Total operating head pressure.

7. Heating Coil Data: (RTU, Reheat).

    a. Identification/number.
    b. Location.
    c. Service.
    d. Manufacturer.
    e. Air flow, design and actual.
    f. Water flow, design and actual.
    g. Water pressure drop, design and actual.
    h. Air pressure drop, design and actual.

8. Air Moving Equipment: (RTU).

    a. Location.
    b. Manufacturer.
    c. Model number.
    d. Serial number.
    e. Arrangement/Class/Discharge.
    f. Air flow, specified and actual.
    g. Return air flow, specified and actual.
    h. Outside air flow, specified and actual.
    i. Total static pressure (total external), specified and actual.
    j. Inlet pressure.
    k. Discharge pressure.
    l. Sheave Make/Size/Bore.
    m. Number of Belts/Make/Size.
    n. Fan RPM.

9. Small Exhaust Fans:

a. Location.
b. Manufacturer.
c. Model number.
d. Serial number.
e. Air flow, specified and actual.
f. Fan RPM.

10. Duct Traverse:

a. System zone/branch.
b. Duct size.
c. Area.
d. Design velocity.
e. Design air flow.
f. Test velocity.
g. Test air flow.
h. Duct static pressure.

11. Air Flow Measuring Station:

a. Identification/number.
b. Location.
c. Size.
d. Manufacturer.
e. Model number.
f. Serial number.
g. Design Flow rate.
h. Actual/final flow rate.

12. Terminal Unit Data:

a. Manufacturer.
b. variable volume, single duct.
c. Identification/number.
d. Location.
e. Model number.
f. Size.
g. Minimum static pressure.
h. Minimum design air flow.
i. Maximum design air flow.
j. Maximum actual air flow.
k. Inlet static pressure.

13. Air Distribution Test Sheet: (Diffusers, Registers).

a. Air terminal number.
b. Room number/location.
c. Terminal type.
d. Terminal size.
e. Area factor.
f. Design velocity.

g. Design air flow.
h. Test (final) velocity.
i. Test (final) air flow.
j. Percent of design air flow.

3.8 IMPORTANCE AND PAYMENTS

A. The entire HVAC portion of this project shall not be considered substantially complete until the balancing is acceptable to the Engineer. Total mechanical payment for HVAC portion of the project beyond 90 percent will not be approved until such balancing and commissioning is acceptable to the Engineer.

END OF SECTION

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SECTION 230700 - HVAC AND PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping system insulation.
2. Piping insulation jackets.
3. Insulation accessories including vapor retarders and accessories.
4. Ductwork insulation.
5. Ductwork insulation jackets.
6. Duct Liner.
7. Equipment insulation.
8. Equipment insulation jackets.

B. Related Sections:

1. Section 230529 - Hangers and Supports and Firestopping for Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
2. Section 230553 - Identification for Piping and Equipment: Product requirements for piping and equipment identification.

1.2 REFERENCES

A. ASTM International:

1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
4. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
5. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
6. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
7. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
8. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
9. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
10. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
11. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
12. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

13. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
14. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
15. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
16. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
18. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

A. Test pipe, duct and equipment insulation for maximum flame spread index of 25 and maximum smoke developed index not exceeding 50 within plenum in accordance with ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storage and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish two year manufacturer warranty for man made fiber.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS (PIPE INSULATION)

A. Owens Corning Fiberglass.

B. Certainteed.

C. Johns-Manville.

D. Knauf, Inc.

E. Rubatex.

F. Armoflex.

G. Imcoshield/Imcolock.

H. Therma-Cel.

2.2 INSULATION (PIPE INSULATION)

A. Type A: Glass fiber insulation; ANSI/ASTM C547; 'k' value of 0.24 at 75°F noncombustible. ASTM C-335.

B. Type B: Cellular glass; Not Used.

C. Type C: Extruded polystyrene insulation: Not Used.

D. Type D: Cellular Foam Insulation: Standard of design is Armaflex Model #AP.

E. Or AEROCEL, ASTM C518 and C534; flexible, cellular elastomeric, molded or sheet.

1. 'K' ('ksi') value: ASTM C177 or C518; 0.28 at 75°F.
2. Minimum service temperature: -40°F.
3. Maximum service temperature: 220°F.
4. Maximum moisture absorption: ASTM D1056; 1.0 by volume. Pipe or sheet.

5. Moisture vapor transmission: ASTM E96; 0.17 perm inches.
6. Connection: Waterproof vapor barrier adhesive.

F. Type E: Polyisocyanurate Foam: Not Used.

G. Type F: Polyolefin/Polyethylene foam (NOT ALLOWED).

2.3 JACKETS (PIPE INSULATION)

A. Vapor Barrier Jacket "ASJ."

1. ASTM C921, ASJ white kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Vapor barrier for polyisocyanurate foam is 4 mil saran vapor barrier film with saran tape at the joints and fittings.
3. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.

B. Indoor, Exposed or Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard ASJ type jacket stapled on six inch centers. Cover fittings, joints and valves.

C. Indoor, Exposed or Concealed Applications: Insulated cold pipes conveying fluids below ambient temperature shall have vapor barrier jackets, ASJ or saran type with positive sealing system. Cover all the fittings, joints, and valves.

D. Tie Wire: 18 gauge stainless steel with twisted ends on maximum 12 inch centers.

E. Where jacketing is near a hot surface, use white aluminum covering for the last six inches of covering.

F. PVC Plastic.

1. Jacket: ASTM C921, one piece molded type fitting covers and sheet material, off white color.

a. Minimum Service Temperature: -40°F.
b. Maximum Service Temperature: 150°F.
c. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
d. Maximum Flame Spread: ASTM E84; 25.
e. Maximum Smoke Developed: ASTM E84; 50.
f. Thickness: 20 mil.
g. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.

2.4 ACCESSORIES (PIPE INSULATION)

A. Adhesives: Compatible with insulation.

B. Insulation Bands: 3/4 inch wide; 0.015 inch thick galvanized steel or 0.007 inch thick aluminum.

C. Metal Jacket Bands: 1/2 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel.

D. PVC Covers: Zestone, Foster, Speedline or equal 0.020 inch thick pre-formed covers for fittings, valves and joints.

E. Flexible valve and fitting covers as manufactured by No Sweat outer wrap shall be impermeable DuPont TyChem over 2" thick insulation blanket and shall be easily removed and reinstalled after service work is completed.

2.5 2.5 ACCEPTABLE MANUFACTURERS OF STANDARD INSULATION FOR EQUIPMENT

A. Owens Corning Fiberglass.

B. Certainteed.

C. Johns-Manville.

D. Knauf, Inc.

E. Armstrong/Rubatex.

F. Or approved equal prior to bidding.

2.6 STANDARD INSULATION (EQUIPMENT INSULATION)

A. Type A: Flexible mineral fiber blanket; Not Used.

B. Type B: Rigid mineral fiber board; ANSI/ASTM C612; 'k' value of 0.24 at 75°F; 6.0 lb/cu ft density.

C. Type C: Cellular glass; Not Used.

D. Type D: Cellular Foam Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. 'K' ('ksi') value: ASTM C177 or C518; 0.28 at 75°F.
2. Minimum service temperature: -40°F.
3. Maximum service temperature: 220°F.
4. Maximum moisture absorption: ASTM D1056; 1.0 by volume. Pipe or sheet.
5. Moisture vapor transmission: ASTM E96; 0.17 perm inches.
6. Connection: Waterproof vapor barrier adhesive.

E. Type E: Elastomeric Foam Adhesive shall be air dried, contact adhesive, compatible with insulation.

2.7 ACCESSORIES (EQUIPMENT INSULATION)

A. Bedding Compounds: Non-shrinking, permanently flexible, compatible with insulation.

B. Vapor Barrier Coating: Non-flammable, fire resistant, polymeric resin, compatible with insulation.

C. Insulating Cement: ANSI/ASTM C195, hydraulic setting mineral wool.

D. Vapor Barrier Jacket.

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film (ASJ jacket).
2. Moisture vapor transmission: ASTM E96; 0.04 perm.
3. Secure with self-sealing longitudinal laps and butt strips for fluids below ambient temperature.
4. Secure with outward clinch expanding staples and vapor barrier mastic for fluids above ambient temperature.

E. PVC Plastic Jackets.

1. ASTM C921, sheet material, off white color.

a. Minimum service temperature: -40°F.
b. Maximum service temperature: 150°F.
c. Moisture vapor transmission: ASTM E96; 0.002 perm inches.
d. Maximum flame spread: ASTM E84; 25.
e. Maximum smoke developed: ASTM E84; 50.
f. Thickness: 20 mil.

2. Connection: Tacks and pressure sensitive, color matching, vinyl tape.
3. Covering Adhesive Mastic compatible with insulation.

2.8 ACCEPTABLE MANUFACTURERS - (DUCT INSULATION)

A. Owens Corning.

B. Certainteed.

C. Johns Manville.

D. Knauf.

E. CSG.

2.9 MATERIALS (DUCT INSULATION)

A. Type A: Flexible glass fiber duct liner; ANSI/ASTM C553; 'k' 0.28 per inch at 75°F; 1.5 lb/cu ft minimum density; coated air side for maximum 4,000 ft/min air velocity.

B. Type B: Rigid glass fiber; ANSI/ASTM C612, Class 1; 'k' value of 0.23 per inch at 75°F; 3.0 lb/cu ft minimum density, 0.002 inch foil scrim or FSK facing for air conditioning, heating and venting ducts. If insulation needs to be painted (in a finished space) provide all purpose (AP) white kraft paper jacket over FSK aluminum jacket.

C. Type C: Flexible glass fiber; ANSI/ASTM C612; commercial grade; 'k' value of 0.29 per inch at 75°F, 0.002 inch foil scrim or FSK facing for air conditioning, heating and venting ducts. 0.75 lb/cu. ft. density for supply ducts, 3.0 lb/cu. ft. density for outside air, exhaust air and relief air ducts. If insulation needs to be painted (in a finished space) provide all purpose (AP) white kraft paper jacket over FSK aluminum jacket.

D. Type D: Flexible glass fiber; ANSI/ASTM C612, Class 1; 'k' value of 0.29 per inch at 75°F, 0.75 lb/cu.ft. Minimum density, 0.002 metalized fiberglass scrim provided in five foot slide-over sleeve length.

E. Type E: AP Armaflex sheet or AP Coilflex Duct Liner: Flexible elastomeric thermal insulation board, 'k' value of 0.25 per inch at 75°F, 3.0 lb/cu.ft. density, with anti-microbial coating, manufactured without use of CFCs, HFCs or HCFCs and suitable for mechanical fasteners or for gluing only with Armaflex 520 adhesive. Support LEED, IECC and ASHRAE 90.1 with R-4.2 at 1" thick, R-6 at 1.5" thick and R-8 at 2" thick.

F. Adhesives: Waterproof fire-retardant type.

G. Lagging Adhesive: Fire resistive to ASTM E84, NFPA 255, UL 723.

H. Joint Tape: Glass fiber cloth, open mesh.

I. Tie Wire: Annealed steel, 16 gauge.

J. Mechanical Fasteners: Pin-type with welded connection to duct side wall. Do not use nail-type fasteners or glue type connections.

K. Vapor Barrier Jacket.

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, 0.0032 inch ASJ jacket.
2. Moisture vapor transmission: ASTM #96; 0.04 perm.
3. Secure with pressure sensitive tape.

2.10 ADHESIVE FOR DUCT INSULATION

A. Water Base Type.

1. Cain - Hydrotak.
2. Duro Dyne - WSA.
3. Hardcast - IA-901.
4. Kingco - 10-568.
5. Miracle - PF-101.
6. Mon-Eco - 22-67.
7. Techno Adhesive - 133.
8. United McGill - Unitack.

B. Solvent Base (Non-Flammable).

1. Cain - Safetak.
2. Duro Dyne - FPG.

3. Hardcast - Glas-Grip 648-NFSE.
4. Kingco - 15-137.
5. Miracle - PF-91.
6. Mon-Eco - 22-24.
7. Techno Adhesive - 'Non-Flam' 106.

2.11 FASTENERS FOR DUCT INSULATION

A. Adhesively secured fasteners not allowed.

B. Approved Manufacturers.

1. AGM Industries, Inc - "DynaPoint" Series DD-9 pin.
2. Cain.
3. Duro Dyne.
4. Omark dished head "Insul-Pins".

C. Grip nails may be used if each nail is installed by "Grip Nail Air Hammer" or by Automatic Fastener Equipment" in accordance with Manufacturer's recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administration Requirements: Coordination and project conditions.

B. Verify that piping has been tested before applying insulation materials.

C. Verify that surfaces are clean, foreign material removed and dry.

3.2 3.2 INSTALLATION (PIPE INSULATION)

A. Install materials in accordance with manufacturer's instructions and as required to meet or exceed the Model Energy Code minimum values.

B. Insulated pipe supported on trapeze type supports shall have a sheet metal saddle installed between the insulation jacket and support (see Specification Section 23 05 29). Notching of pipe insulation around the support member is not acceptable.

C. Continue insulation with vapor barrier through penetrations, i.e. through floor slab and wall sleeves.

D. In exposed piping, locate insulation and cover seams in least visible locations.

E. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. For insulation with self-sealing adhesive tab, install insulation such that the vapor barrier seal tab folds down towards the bottom of the pipe.

F. For insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier.
2. For hot piping conveying fluids 140°F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation. (Domestic water).
3. For hot piping conveying fluids over 140°F insulate flanges and unions at equipment but bevel and seal ends of insulation at such locations. (Steam piping and Hydronic Piping).
4. Piping (6" or smaller): Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe and finish with ASJ or PVC jacket as follows in this Part 3.

G. Insulated cold pipes conveying fluids below ambient temperature. (Domestic cold, water).

1. Provide vapor barrier jackets with the factory applied positive sealing system at seams. (Also seal all joints.).
2. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations.
3. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies and expansion joints.
4. Piping (6" and smaller): Insulate fittings, joints and valves with insulation of like material and thickness as adjacent pipe finish with ASJ or PVC jacket as follows in this Part 3.

H. Provide an insert, not less than 6 inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2 inches diameter or larger, to prevent insulation from sagging at support points. Inserts shall be cork or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used.

I. Neatly finish insulation at supports, protrusions and interruptions.

J. Pipe covering shall be started at the coil or piece of equipment. All piping and valves serving each coil or item of equipment including all branch arms shall be insulated. The last few feet of piping may not be left uninsulated.

K. For pipe exposed in finish spaces PVC jacket and fitting covers. Piping in roof truss space of a finished space does not require PVC jacketing.

L. For pipe exposed in mechanical equipment rooms below 6 feet above finished floor, finish with PVC jacket and fitting covers.

M. Install No-Sweat flexible insulation system at all cold domestic valves and flow fittings such that removal for servicing and testing and balancing leave the jacket and insulation intact and ready for reinstallation.

3.3 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated. Substituted materials must be submitted for Engineer's approval prior to installation.

3.4 SCHEDULE

PIPING	TYPE	PIPE SIZE	INSULATION THICKNESS
DOMESTIC COLD WATER	A/D	UP TO 3/4"	1/2"
DOMESTIC COLD WATER	A/D	1" AND OVER	1"
DOMESTIC HOT WATER	A/D	UP TO 1-1/4"	1"
DOMESTIC HOT WATER	A/D	1-1/2" AND OVER	1-1/2"
CIRCULATING HOT WATER	(INSULATE SAME AS DOMESTIC HOT WATER)		
RAIN WATER, A.F.F., VERTICAL PIPING	A	ALL	1"
RAIN WATER, A.F.F., HORIZONTAL PIPING	A	ALL	1"
ROOF DRAIN SUMP BOWLS	A	ALL	1"
HEATING WATER SUPPLY AND RETURN	A	3/4" TO 1-1/4”	1-1/2"
HEATING WATER SUPPLY AND RETURN	A	1-1/2” AND UP	2"
CONDENSATE DRAIN LINES	D	ONLY ON STEEL AND COPPER	3/4"

NOTE:	PEXA AND POLYPROPYLENE PIPING SHALL HAVE THE SAME INSULATION REQUIREMENTS AS COPPER OR STEEL.
NOTE:	REDUCTION OF PIPE INSULATION THICKNESS BY 1 INCH SHALL BE PERMITTED FOR HOT WATER PIPING AND DOMESTIC COLD WATER PIPING SMALLER THAN 1-1/2” WHEN LOCATED WITHIN A PARTITION IN THE “CONDITIONED SPACE”, BUT NOT TO A THICKNESS LESS THAN 1 INCH. CHILLED WATER PIPING INSULATION CANNOT BE REDUCED FOR ANY REASON.

3.5 PAINTING (PIPE INSULATION)

A. None.

3.6 EXPOSED KITCHEN AND TOILET PIPING INSULATION

A. All exposed hot water, cold water, drain, steam and condensate piping in the kitchen and toilet areas shall be insulated and covered with PVC jacket from floor, wall or ceiling to connected equipment.

3.7 EXAMINATION (EQUIPMENT INSULATION)

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.8 3.8 INSTALLATION (EQUIPMENT INSULATION)

A. Install materials in accordance with manufacturer's instructions.

B. Do not insulate factory insulated equipment.

C. On exposed equipment, locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with studs, pins, clips, adhesive, wires, bands or facing.

E. Fill joints, cracks, seams, and depressions with bedding compound to form a smooth surface. On cold equipment, use vapor barrier jacket over cement.

F. For insulated equipment containing fluids above ambient temperature:

1. Provide standard ASJ jackets, with or without vapor barrier, factory applied or field applied.
2. For hot equipment containing fluids 140°F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
3. For hot equipment containing fluids over 140°F, insulate flanges and unions with removable sections and jackets.

G. Finish insulation at supports, protrusions, and interruptions.

H. For equipment in mechanical equipment rooms below six feet above floor finish with PVC jacket and fitting covers.

I. Install insulation for equipment requiring access for maintenance, repair, or cleaning, in such a manner that it can be easily removed and replaced without damage.

3.9 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.10 SCHEDULE

EQUIPMENT	INSULATION TYPE	THICKNESS
PUMP BODIES	NONE	N/A
AIR SEPARATORS	B/D	1-1/2"
EXPANSION TANKS	NONE	N/A
AIR/HYDRAULIC SEPARATOR COMBINATIONS	B/D	1-1/2”

3.11 PAINTING

A. None.

3.12 PREPARATION (DUCT INSULATION)

A. Install external materials after ductwork has been approved.

B. Insulated ductwork conveying air conditioning, room air or air below ambient temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying heating air or air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. For exterior applications, provide R-12 insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

E. Liner (Type A) Application: Only inside transfer ducts for sound attenuation.

1. Adhere insulation with mechanical fasteners and adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 15 inch centers maximum on all sides of ductwork per manufacturer's instruction. Seal and smooth joints. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

F. External Insulation (Type B or Type C) Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.

Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

4. Seal all insulation butt joints and insulation terminations at diffusers, registers, branch ducts and main duct connections with tape such that no insulation is left exposed to ambient air.

G. External Insulation (Type D) Application:

1. Secure insulation with vapor barrier sleeve using vapor barrier adhesive tape.
2. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping or vapor barrier.
3. Slide sleeve over round branch ducts in five foot lengths.
4. Seal all insulation butt joints and insulation terminations at diffusers, registers, branch ducts and main duct connections with tape such that no insulation is left exposed to ambient air.

H. Liner (Type E) Application:

1. Adhere insulation with mechanical fasteners adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 15 inch centers maximum on all sides of ductwork per manufacturer's instruction. Seal and smooth joints. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
2. As an option Armaflex 520 adhesive may be used without additional fasteners.

I. Ductwork dimensions indicated on Drawings are actual metal dimensions. Increasing duct dimensions for duct liner insulation thickness is not necessary. Round dimensions are the clear inside diameter after insulation.

J. Lag ductwork where indicated by applying insulation wrap with weighted jacket over to ductwork. Applied covering to be airtight. Attach covering to duct per manufacturer's instructions.

3.13 TOLERANCE (DUCT INSULATION)

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.14 FAN POWER SYSTEMS (DUCT INSULATION)

A. All fan powered supply air system such as air handling units, fan coil units and packaged rooftop units shall have Type E liner for a minimum of the first fifteen feet of supply and return duct (or more as shown on the plan sheets). The minimum fifteen feet shall include the vertical drop from RTU equipment.

B. After the minimum fifteen feet (or more as shown) of Type-E lined duct from the fan discharge, externally wrapped duct insulation and vapor barrier jacket shall be used, unless the duct work involved is exposed to the conditioned air space, such as gymnasium, cafeteria, etc.

3.15 FLEXIBLE CONNECTORS (DUCT INSULATION)

A. Provide 1" fiberglass insulation and vapor barrier jacket over entire connector to a point 12" downstream of connector.

3.16 DUCT INSULATION SCHEDULE

DUCTWORK	TYPE	INSULATION THICKNESS	FINISH
INTERNAL LINING DOWNSTREAM OF VAV BOXES	E	1”	NONE
INTERNAL LINING IN SUPPLY DUCTS (WHERE NOTED)	E	1"	NONE
INTERNAL LINING IN RETURN DUCTS(WHERE NOTED)	E	1"	NONE
INTERNAL LINING IN RETURN AIR TRANSFER	A	1"	NONE
UNLINED EXHAUST DUCT AND RELIEF DUCT WITHIN 10' OF EXTERIOR OPENING	B	2"	VAPOR BARRIER
ROUND METAL INTERIOR SUPPLY DUCTS	C	1-1/2"	VAPOR BARRIER
ROUND METAL INTERIOR SUPPLY DUCTS	D	1-1/4"	VAPOR BARRIER
OUTSIDE AIR INTAKE (R-8 MINIMUM)	B	2"	VAPOR BARRIER
OUTSIDE AIR AND RELIEF AIR DUCTWORK EXPOSED BELOW 8’ AFF (R-8 MINIMUM)	B	2”	VAPOR BARRIER
COMBUSTION AIR (R-8 MINIMUM)	B / C	2"	VAPOR BARRIER
RECTANGULAR INTERIOR SUPPLY DUCTS (WHERE DUCT IS UNLINED)	B	1-1/2"	VAPOR BARRIER
FLEXIBLE CONNECTORS AT SUPPLY AIR DUCTWORK	B / C	1-1/2"	VAPOR BARRIER
SOUND TRAPS	B / C	1-1/2"	VAPOR BARRIER
VAV BOX REHEAT COILS	C	1-1/2"	VAPOR BARRIER

A. Notes:

1. On the Plans where ductwork is noted as “10/10 L”, the “L” designates duct liner.

2. On the Plans where ductwork is noted as __ ” I.D.”, “the I.D.” indicates inside dimension and also designates the duct as double wall insulated duct. External insulation is not required.
3. Supply air ductwork downstream of VAV box shall have 1” Type E liner for a minimum of five feet (or more as shown on plans).
4. All external wrap insulation exposed from floor to 8' above finish floor shall be rigid Type-B insulation with a PVC vapor barrier jacket.
5. Insulation thickness shall be verified for all ductwork that is installed outside the building insulation envelope in attics, garages and ventilated crawl spaces such that a R-12 value is maintained and a vapor barrier jacket is included.
6. Insulation thickness on all ductwork outside the building’s insulation envelop shall be verified to be R-12 minimum value. Such locations include ducts inside roof curbs and roof deck support areas above a roof for mechanical equipment, i.e. exposed roof deck inside curb.

END OF SECTION

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SECTION 230915 - CARBON MONOXIDE/NITROGEN DIOXIDE SENSING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Building sensors for carbon monoxide and nitrogen dioxide. (Provided by BAS.).

1.2 RELATED SECTIONS

A. Section 230923 - Direct Digital Control Systems.

B. Section 230993 - Sequence of Operation.

C. Section 238103 - Packaged Rooftop AC Units.

D. Section 260503 - Equipment Wiring Systems.

1.3 REFERENCES

A. ASHRAE 62-2001 Acceptable Indoor Air Quality Standards.

B. NFPA Monoxide Handbook.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Coordinate submittals with information requested in Section 23 09 93.

C. Product Data: Submit description and engineering data for each control system component. Include sizing as requested.

D. Manufacturer's Installation Instructions: Submit.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of control components, including panels and sensors.

C. Operation and Maintenance Data: Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with State of Minnesota standards.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept controls on site in original factory packaging Inspect for damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of control system for one year from Date of Substantial Completion.

C. Furnish complete service of controls systems, including callbacks. Make minimum of two complete normal inspections of approximately four hours duration in addition to normal service calls to inspect, calibrate and adjust controls. Submit written report after each inspection.

D. Include systematic examination, adjustment, and calibration of controls. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

E. Perform work without removing units from service during building normal occupied hours.

F. Provide emergency call back service during working hours for this maintenance period.

G. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

H. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

I. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brasch.

B. Intec by QEL, Inc.

C. Tox-Alert.

D. Approved equal prior to bidding.

2.2 CONTROL PANEL

A. The control panel shall be ETL listed containing a digital control board and power supply/relay board and shall conform completely to the UL 61010B-1 and certified to CAN/CSA STD. C22.2, No. 1010.1.

B. The NEMA 1 enclosure shall be constructed of heavy gauge, bonderized steel with gray, painted finish and conforms to the UL 61010B-1 standard. The cover shall close flush with the sides of the box and be secured with a keyed lock that protects the front panel controls when locked.

C. The enclosure shall have 6, 1/2" knockouts and 6, 3/4" knockouts, pre-punched for connection of field conduit.

D. The unit shall be protected against static discharge, excessive electrical noise, and tested for safety in accordance with the UL 61010B-1 standard.

E. The unit shall have a four line, 20 characters per line, LC display that will continually indicate the present date and time on the top two lines and user instructions on the top two lines and user instructions on the bottom two lines.

F. Programming and current status of the unit and all sensors shall be controlled from a front panel 5 key keypad. Factory programming to the user's specifications is available.

2.3 SWITCHES AND CONTROLS

A. Each sensor connected to the control panel shall provide an 8-bit, digital signal in direct relationship to the concentration of the type of gas being monitored. Sensors are connected in "daisy chain" fashion for both power and signal.

B. The control panel shall have the capability of assigning each sensor to a specific output ventilation control zone, or to multiple control zones. Sensors may control zones individually or in combination with other sensors.

C. A key on the keypad shall be provided to silence the internal alarm. The alarm circuit will automatically be reset once the current alarm condition ceases to exist.

D. Output relays providing a normally closed set of contacts for low alert and the alarm shall be provided. These relays shall provide a fail-safe situation and will automatically operate ventilation equipment upon power loss to the control panel or sensor. The low and high alert relays shall have a field selectable configuration for 2-speed or 50%/100% fan control. Relays shall be suitable for the connection of 24 VAC, 24 VA inductive circuits.

E. Field adjustment of the low-alert detection level shall be available for each sensor. The range of the detection level shall depend upon the type of gas being monitored. An on/off time delay range of 0 to 10 minutes in increments of one (1) minute shall be available for all sensors.

F. The control panel shall come standard with the capability to accept up to 20 transmitters/sensors and control up to six (6) output zones.

G. The control panel shall have a battery backup feature capable of retaining the programmed parameters in case of a power loss.

2.4 CONTROL PANEL ELECTRICAL

A. The control panel shall contain a supply fuse rated for 1-amp at 250 VAC. Each output relay shall have a fuse rated for 5-amps at 250 VAC. The fuses shall be of the time-log type similar to Wickmann Series 374.

B. Keypad: 5 embossed keys with tactile feedback.

C. Timing: Real-time clock with output for minutes, hours, day-of-week, day, month and year.

D. Circuit: Microprocessor controlled digital circuitry with battery backup, (up to 10 year lifetime).

E. Input Channels:

1. Number - 20 inputs, (max.).
2. Type - Model GSE-CM-TRA, Model GSE-ND-TRA transmitters.
3. Input Signal - 8-bit digital word, RS-485 transceiver.

4. Connection - Inputs are true daisy-chain, both power and communication.
5. Maximum Distance - 1000 feet between most remote input transmitter and panel.

F. Output Channel.

1. Number - 6 outputs, (std.).
2. Type of Output - Two each, dry-contact, mechanical relays per channel, fused at amps.
3. Maximum Voltage Rating - 125 VAC, 50/60 Hz.
4. Current Capacity - 5 amps, resistive at 30 VDC.
5. Power (Inductive) - 250 VA (1/8 HP).

2.5 CARBON MONOXIDE - ELECTRO-CHEMICAL SENSOR #GSE-CM-TRA

A. The sensor/transmitter shall be an ETL listed unit and conform completely to the UL 61010-1 standard.

B. The NEMA 1 enclosure shall be constructed of heavy polycarbonate plastic, which consists of two pieces, cover and chassis. The cover shall close flush with the sides of the box and shall require a special tool to open it. The sensor module shall be protected from damage inside the enclosure. The gas sensor shall be exposed to the ambient air to allow for proper sensing. The case shall conform to the UL 61010-1 standard.

C. The sensor/transmitter shall contain an electro-chemical carbon monoxide (CO) sensor with temperature compensation circuits.

D. The enclosure shall be provided with one, 1/3" pre-punched opening for connection of field conduit.

E. The sensor/transmitter shall be protected against static discharge, excessive electrical noise and tested for safety in accordance with the UL 61010-1 standard.

F. The sensor/transmitter shall have a green "power" LED.

G. Overcurrent Protection: The sensor/transmitter shall contain two power supply fuses rated for 0.200 amp at 250 VAC. Fuses shall be of the time-lag type.

H. Switches and Controls: The sensor/transmitter shall provide a 4-20 ma DC, 0-1 VDC, 0-5 VDC or 0-10 VDC signal in direct relationship to the carbon monoxide (CO) gas concentration. The signal type can be selected at time of order or changed in the field. This signal shall be compatible with building and energy management systems and/or Brasch Manufacturing, Multi-Sensor Control Panels.

I. Alarm Channel - One internal and one external, common to all output channels.

1. Internal.

a. Type - Piezoelectric ceramic element.
b. Frequency - 3.7 KHz.
c. Sound Level - 110 db. @ 10 cm.

2. External (for optional, remote-mounted horn/strobe).

a. Type - One each, dry-contact, mechanical relay, fused at 5 amps.
b. Maximum voltage - 125 VAC, 50/60 Hz.
c. Current capacity - 5 amps, (resistive) at 30 VDC.
d. Power, (inductive) - 250 VA, (1/8 HP).

J. Environmental:

1. Temperature.

a. Operating: -15°C to 40°C, (5°F to 104°F).
b. Storage: -50°C to 120°C, (-58°F to 248°F).

2. Humidity.

a. Operating: 10% to 90%, (non-condensing).
b. Storage: 10% to 90%, (non-condensing).

K. Accuracy:

1. CSE-CM-TRA transmitters shall be accurate to within ± 10% of the full scale value for carbon monoxide with 0-200ppm range.

L. Expected Useful Lifetime:

1. GSE-CM-TRA - 5 years or greater.

2.6 NITROGEN DIOXIDE - ELECTRO-CHEMICAL

A. The sensor/transmitter shall be an ETL listed unit and conform completely to the UL 61010-1 standard.

B. The NEMA 1 enclosure shall be constructed of heavy polycarbonate plastic, which consists of two pieces of cover and chassis. The cover shall close flush with the sides of the box and shall require a special tool to open it. The sensor module shall be protected from damage inside the enclosure. The gas sensor shall be exposed to the ambient air to allow for proper sensing. The case shall conform to the UL 6101-1 standard.

C. The sensor/transmitter shall contain an electro-chemical nitrogen dioxide (NO2) sensor with temperature compensation circuits.

D. The enclosure shall be provided with one, 1/2" pre-punched opening for connection of field conduit.

E. The sensor/transmitter shall be protected against static discharge, excessive electrical noise, and tested for safety in accordance with the UL 6101-1 standard.

F. The sensor/transmitter shall have a green "power" LED.

G. Overcurrent Protection: The sensor/transmitter shall contain two power supply fuses rated for 0.200 amp at 250 VAC. Fuses shall be of the time-lag type.

H. Switches and Controls: The sensor/transmitter shall provide a 4-20 ma DC, 0-1 VDC, 0-5 VDC or 0-10 VDC signal in direct relationship to the nitrogen dioxide (NO2) gas concentration. The signal type can be selected at time of order or changed in the field. This signal shall be compatible with building and energy management systems and/or Brasch Manufacturing, Multi-Sensor Control Panels.

I. Alarm Channel - One internal and one external, common to all output channels.

1. Internal.

a. Type - Piezoelectric ceramic element.
b. Frequency - 3.7 KHz.
c. Sound Level - 110 db. @ 10 cm.

2. External (for optional, remote-mounted horn/strobe).

a. Type - One each, dry-contact, mechanical relay, fused at 5 amps.
b. Maximum voltage - 125 VAC, 50/60 Hz.
c. Current capacity - 5 amps, (resistive) at 30 VDC.
d. Power, (inductive) - 250 VA, (1/8 HP).

J. Environmental:

1. Temperature.

a. Operating: -15°C to 40°C, (5°F to 104°F).
b. Storage: -50°C to 120°C, (-58°F to 248°F).

2. Humidity.

a. Operating: 10% to 90%, (non-condensing).
b. Storage: 10% to 90%, (non-condensing).

K. Accuracy:

1. CSE-ND-TRA transmitters shall be accurate to within ± 10% of the full scale value for nitrogen dioxide with 0-10ppm range.

L. Expected Useful Lifetime:

1. GSE-CM-TRA - 5 years or greater.

2.7 COMBINATION CO AND NO2 - ELECTRO-CHEMICAL

A. The sensor/transmitter shall be an ETL listed unit and conform completely to the UL 61010-1 standard.

B. The NEMA 1 enclosure shall be constructed of heavy polycarbonate plastic, which consists of two pieces, cover and chassis. The cover shall close flush with the sides of the box and shall require a special tool to open it. The sensor module shall be protected from damage inside the

enclosure. The gas sensor shall be exposed to the ambient air to allow for proper sensing. The case shall conform to the UL 61010-1 standard.

C. The sensor/transmitter shall contain an electro-chemical carbon monoxide (CO) sensor with temperature compensation circuits and an electro-chemical nitrogen dioxide (NO2) sensor.

D. The enclosure shall be provided with one, 1/2" pre-punched opening for connection of field conduit.

E. The sensor/transmitter shall be protected against static discharge, excessive electrical noise, and tested for safety in accordance with the UL 61010-1 standard.

F. The sensor/transmitter shall have a green "power" LED.

G. Overcurrent Protection: The sensor/transmitter shall contain two power supply fuses rated for 0.200 amp at 250 VAC. Fuses shall be of the time-lag type.

H. Switches and Controls: The sensor/transmitter shall provide a 4-20 ma DC, 0-1 VDC, 0-5 VDC or 0-10 VDC signal in direct relationship to the nitrogen dioxide (NO2) and carbon monoxide (CO) gas concentrations. The signal types can be selected at time of order or changed in the field. The signal shall be compatible with building and energy management systems and/or Brasch Manufacturing, Multi-Sensor Control Panels.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install remote sensors for each system where directed by plan.

C. Sensors shall be provided as required to provide a minimum of one sensor for every 9,000 square feet of building area.

END OF SECTION

SECTION 230923 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC (EXTENSION OF EXISTING AUTOMATION SYSTEM)

PART 1 GENERAL

1.1 PRODUCTS FURNISHED, BUT NOT INSTALLED UNDER THIS SECTION

A. Section 232113 Hydronic Piping.

1. Flow Switches.
2. Temperature Sensor Wells and Sockets.
3. Control Valves.

B. Section 233300 - Ductwork Accessories.

1. Automatic Dampers.

C. Section 230933 Variable Frequency Motor Controllers that are provided as part of packaged RTU equipment, DOAS equipment and MUA units.

1.2 RELATED SECTIONS

A. Section 230500 - Basic Fire Protection, Plumbing and HVAC Requirements.

B. Section 230593 - Testing, Adjusting and Balancing for HVAC.

C. Section 230915 - CO/NO2 Sensing.

D. Section 230933 - Variable Frequency Motor Controllers.

E. Section 230993 - Sequence of Operation.

F. Section 238103 - Packaged Rooftop Air Conditioning Units.

G. Section 260500 - Basic Electrical Requirements.

1.3 CODES, STANDARDS AND REFERENCES

A. Air Movement and Control Association (AMCA).

B. American National Standards Institute (ANSI).

C. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

1. ASHRAE 135-2004 BACnet Standard.

D. Federal Communications Commission (FCC).

E. Institute of Electrical and Electronics Engineers (IEEE).

F. International Organization for Standardization (ISO).

G. National Electrical Manufacturers Association (NEMA).

H. National Fire Protection Association (NFPA).

I. Underwriters Laboratories (UL).

J. U.S. National Archives and Records Administration (NARA).

1.4 DEFINITIONS

A. Insure terminology used in submittals conforms to ASHRAE\85 or ASME MC85.1.

1.5 SYSTEM DESCRIPTION

A. Building Automation System field monitoring and control system using field programmable micro-processor based units. All new equipment shall be compatible with the existing system.

B. All necessary central and remote hardware, software and interconnecting wire and conduit shall be provided.

C. Terminal unit controls for variable air volume terminals, radiation, reheat coils, unit heaters, air handling units shall all be electronic.

1.6 SUBMITTALS

A. Extensive effort has been performed to provide a detailed written Sequence of Operations on the plan sheets. This BAS Contractor shall insert the Sequence of Operations from the plan sheets directly into their submittal.

1. If the Contractor wishes to change the description in any way, that change must be approved by the Design Engineer before their drawings are submitted.
2. Submittals that do not include this sequence of operations requirement will not be reviewed or approved.
3. This is being required to ensure the best coordination possible between this submittal and the drawings original intent, to avoid contradictions and to provide the best document clarity possible for the owner.

B. Shop drawings shall be 11 inch by 17 inch, landscape, bound on the left edge. They shall be produced with Microsoft Visio. Organize the packages by building.

1. All valve and damper schedules shall be as large as possible on individual 11x17 sheets.

C. All text based documents and product data sheets shall be 8 ½ inch by 11 inch format bound on the left edge. To the maximum extent possible, Adobe Acrobat shall be used to produce the documents in a portable document format (PDF).

D. Software files shall be submitted on fully labeled CDs that shall include a table of contents file in PDF format that provides a description of all of the files on the CD.

E. Submittals Prior To Construction.

1. Shop Drawings.

a. System Architecture Design Diagram.

1) This is a riser diagram that shall show the IP layer and all of the field bus layers.
2) It shall show each computer, printer, router, repeater, controller, and protocol translator that is connected to either the IP layer or any of the field busses.
3) Each component that is shown shall have a name that is representative of how it will be identified in the completed database and the manufacturer's name and model number.
4) The physical relationship of one component to another component shall reflect the proposed installation. Example: If AHU1 controller is the closest controller to the Building Controller on the field bus, then this device shall be shown as the first device on the riser diagram just below the Building Controller.
5) This diagram shall not include power supplies, sensors or end devices.

b. Layout Design Drawing for each control panel:

1) The layout drawing shall be to scale with all devices shown in their proposed positions.
2) All control devices shall be identified by name.
3) All terminal strips and wire channels shall be shown.
4) All control transformers shall be shown.
5) All 120 VAC receptacles shall be shown.
6) All IP connection points shall be shown.

c. Wiring Design Diagram for each control panel.

1) The control voltage wiring diagram shall clearly designate devices powered by each control transformer. If the control devices use half wave power, the diagram shall clearly show the consistent grounding of the appropriate power connection. All wire identification numbers shall be annotated on the diagram.
2) The Field Bus wiring diagram shall clearly show the use of the daisy chain wiring concept, the order in which the devices are connected to the Field Bus, and the location of end of segment termination devices. All wire identification numbers shall be annotated on the diagram.
3) If shielded communication wiring is used, the grounding of the shield shall be shown.
4) The terminal strip wiring diagram shall identify all connections on both sides of the terminal strip. Wiring label numbers for all wiring leaving the control panel shall be annotated on the diagram.

d. Wiring Design Diagram for individual components (controllers, protocol translators, etc.): The wiring diagram for each component shall identify all I/O, power, and

communication wiring and the locations on the terminal blocks to which the wires are landed. Example: Fan Status sensor is wired from terminals 5/6 on the controller to terminals 17 and 18 on the terminal strip.

e. Installation Design Detail for each I/O device.

1) A drawing of the wiring details for each sensor and/or end device.
2) For devices with multiple quantities, a standard detail may be submitted.

f. A System Flow Design Diagram for each controlled system including:

1) A two dimensional cross sectional diagram showing keycomponents such as fans, coils, dampers, valves, pump, etc.
2) Identification of locations and names of all sensors and end devices that are associated with the control system. Label the panel name and terminal numbers where the connections are landed.
3) A legend shall be provided for all symbols used.

g. Product Data: Provide data for each system component and software module.
h. Manufacturer's Installation Instructions: Include for all manufactured components.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual location of control components, including panels, thermostats and sensors.

B. Revise shop drawings to reflect actual installation and operating sequences. Also show any existing system modification to the existing system. Submit two sets of revised drawings to the owner at completion of the contract.

C. During the construction, Contractor shall maintain a clean set of drawings for the sole purpose of recording changes and actual “as installed” information. Marking of the record set shall be done methodically as work progresses, clearly and neatly, in color.

D. As a general guide, the type of information to be recorded on the record set includes:

1. Revisions made, except minor or non-critical dimensions.
2. Omissions, including work omitted by accepted alternates.
3. Locations of control valves and dampers.
4. Additions to the work.
5. Changed footage or other elevations.
6. Changes in locations of control panelboards, control equipment, outlets, control dampers and other similar data.

E. Include above data specified in "Submittals" in final "Record Documents" form.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01.

B. Include interconnection wiring diagrams complete field installed system with identified and numbered, system components and devices.

C. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

D. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.9 QUALIFICATIONS

A. Manufacturer: Schneider Electric - EcoStruxure.

B. Installer: UHL Co.

1.10 PRE-INSTALLATION CONFERENCE

A. Convene a conference one week prior to commencing work of this Section, under provisions of Division 01.

B. Require attendance of all parties directly affecting the work of this Section.

1.11 COORDINATION

A. Insure installation of components is complementary to installation of similar components in other systems.

B. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and VAV air terminal units.

C. The Contractor shall be fully responsible for the complete installation and commissioning of the BAS System extension including, but not limited to, interfacing of new and existing BAS equipment, sensors and controls, existing central computer, programming peripherals, communication links and new remote panel programming.

D. After the installation the Contractor shall be responsible for debugging and calibration, including software and application strategies.

E. Contractor shall be responsible for “all on-site programming and editing required to provide a fully operational BAS System extension. (System extension shall be 100 percent programmed for all points listed in I/O Summary Table.).

F. Insure system is completed and commissioned.

1.12 WARRANTY

A. Provide one year warranty under provisions of the contract following final acceptance of the project by the Architect/Owner.

B. Warranty: Include coverage for field programmable micro-processor based units and all installed equipment and accessories.

1.13 MAINTENANCE SERVICE

A. Furnish service and maintenance of energy management and control system for one year.

B. Provide service of systems, including call backs. Make minimum of two complete normal inspections of approximately four hours duration in addition to normal service calls to inspect, calibrate, and adjust controls and submit written reports.

1.14 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software extension, the Owner and the party providing the software will enter into a revised software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.1 MANUFACTURERS (BMS) BUILDING MANAGEMENT SYSTEMS

A. Schneider Electric - EcoStruxure.

B. No approved equals.

2.2 GENERAL PRODUCT DESCRIPTION

A. The extension of the existing Facility Management System (FMS) shall be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management and trend data collection.

B. The FMS shall consist of the following:

1. Connection to the existing Digital Panel.
2. Standalone Application Specific Controllers (ASCs).

C. The system is modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, ASCs and operator devices. Each remote panel shall have a minimum of 10 percent spare capacity for future point connection. The type of spares

shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two (2) spares of each implemented I/O type. Provide all processors, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring. Provide sufficient internal memory for the specified control sequences and have at least 15 percent of the additional memory available for future use.

D. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2.3 NETWORKING/COMMUNICATIONS

A. The extension of the existing FMS shall be integrated into existing network. Inherent in the system's design shall be the ability to expand or modify the network either via a local or web-based network.

B. Local Network.

1. Computer/Panel Support: The existing Computer or Digital Panel shall directly oversee a local network such that communications may be executed directly to and between ASCs. The Personal Computer version and Digital Panel version shall be referred to as the "Digital Panel(s)" throughout this document.
2. Data Access: All operator devices shall have the ability to access all point status and application report data on the network. Access to system data shall not be restricted by the hardware configuration of the facility management system.
3. Global Data Sharing: Global Data Sharing or Global Point Broadcasting shall allow point data to be shared between ASCs, when it would be inefficient or impractical to locate multiple sensors.
4. General Network Design: Network design shall include the following provisions:

    a. Data transfer rates for alarm reporting and quick point status from multiple ASCs. The minimum baud rate shall be 9600 baud.
    b. Support of any combination of ASCs. A minimum of 100 ASCs shall be supported on a single local network. The bus shall be addressable for up to 155 ASCs.
    c. Detection of a single or multiple failures of ASCs or the network media.
    d. Error detection, correction and retransmission to guarantee data integrity.
    e. Commonly available, multiple-sourced, networking components shall be used.
    f. Use of an industry standard protocol, such as Optomux and IEEE RS-485 communications interface.

2.4 DIGITAL PANELS

A. General: Digital panels shall be microprocessor-based, multi-tasking, multi-user, digital control processors.

B. Memory: Each digital panel shall have sufficient memory to support its own operating system and data bases including:

1. Control processed.

2. Energy Management Applications.
3. Alarm Management.
4. Trend Data.
5. Maintenance Support Applications.
6. Operator I/O.
7. Dial-Up Communications.
8. Manual Override Monitoring.

C. Expandability: The system shall be modular in nature and shall permit easy expansion through the addition of field controllers, sensors and actuators.

D. Serial Communication Ports: Digital panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as lap-top computers, personal computers and video display terminals.

E. Hardware Override Monitoring: Digital panels shall monitor the status of all overrides and include this information in logs and summaries to inform the operator that automatic control has been inhibited.

F. Integrated On-Line Diagnostics: Each digital panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. Digital panels shall provide both local and remote annunciation of any detected component failures or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each digital panel.

G. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

H. Power Fail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of the Digital Panel to prevent the loss of data base or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real time clock and all volatile memory for a minimum of 72 hours. Upon restoration of normal power, the Digital Panel shall automatically resume full operation without manual intervention. Should Digital Panel memory be lost for any reason, the user shall have the capability of reloading the Digital Panel via the local RS-232C port or telephone line dial-in.

2.5 SYSTEM SOFTWARE FEATURES

A. General.

1. All necessary software extensions to form a completely integrated operating system for the entire complex, as described in this specification, shall be provided.
2. The software programs specified in this section shall be provided as an integral part of the Digital Panel and shall not be dependent upon any higher level computer for execution.

B. Control Software Description.

1. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
2. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

C. Energy Management Applications: Digital Panels shall have the ability to perform any or all of the following energy management routines:

1. Time of scheduling.
2. Calendar based scheduling.
3. Holiday scheduling.
4. Optimal start.
5. Optimal stop.
6. Load rolling.
7. Heating/Cooling interlock.

D. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment described in the "Execution" portion of this specification.

E. Programming Capability: Digital Panels shall be able to execute configured processes defined by the user to automatically perform calculations and control routines.

1. Process Inputs and Variables: It shall be possible to use any of the following in a configured process:

a. Any system-measured point data or status.
b. Any calculated data.
c. Any results from other processes.
d. Boolean logic operators (and, or).

2. Process Triggers: Configured processes may be triggered based on any combination of the following:

a. Time of day.
b. Calendar date.
c. Other processes.
d. Events (e.g., point alarms).

3. Data Access: A single process shall be able to incorporate measured or calculated data from any and all other ASCs.
4. In addition, a single process shall be able to issue commands to points in any and all other ASCs on the local network.

2.6 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

A. Each digital panel shall be able to extend its monitoring and control through the use of standalone Application Specific Controllers (ASCs).

B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a micro-processor-bases, multi-tasking, real-time digital control processor.

C. Each ASC shall have sufficient memory to support its own operating system and data bases including:

1. Control Processes.
2. Energy Management Applications.
3. Operator I/O (Portable Service Terminal).

D. Application Descriptions:

1. VAV Modular Assembly (VMA):

a. The VAV Modular Assembly shall provide both standalone and networked direct digital control of pressure-independent, variable air volume terminal units. It shall address both single and dual duct applications.
b. The VAV Modular Assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece.
c. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in30 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.
d. The controller shall determine airflow by dynamic pressure measurement using an integral dead-ended differential pressure transducer. The transducer shall be maintenance-free and shall not require air filters.
e. Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature/humidity effects.
f. The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
g. Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. In addition, this tuning reduces commissioning costs, and eliminates the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.
h. The controller shall provide the ability to download and upload VMA configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
i. Control setpoint changes initiated over the network shall be written to VMA non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
j. The controller firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.

k. The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
l. The controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain ("K" factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
m. Controller performance shall be self-documenting via on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance. The VMA shall calculate exponentially weighted moving averaged (EWMA) for each of the following. These metrics shall be available to the end user for efficient management of the VAV terminals.

    1) Absolute temperature loop error.
    2) Signed temperature loop error.
    3) Absolute airflow loop error.
    4) Signed airflow loop error.
    5) Average damper actuator duty cycle.

n. The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:

    1) Unreliable space temperature sensor.
    2) Unreliable differential pressure sensor.
    3) Starved box.
    4) Actuator stall.
    5) Insufficient cooling.
    6) Insufficient heating.

o. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user check damper position. The VMA would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.
p. The controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality), and shall be capable of resetting the box minimum airflow based on the percent of outdoor air in the primary air stream.
q. The controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.
r. Inputs:

    1) Analog inputs with user defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:

        a) 0-10 VDC Sensors.
        b) 1000ohm RTDs.
        c) NTC Thermistors.

2) Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
3) For noise immunity, the input shall be internally isolated from power, communications, and output circuits.
4) Provide side loop application for humidity control.

s. Outputs:

1) Analog outputs shall provide the following control outputs: 0-10 VDC.
2) Binary outputs shall provide a SPST Triac output rated for 500 mA at 24 VAC.
3) For noise immunity, the outputs shall be internally isolated from power, communications and other output circuits.

t. Application Configuration.

1) The VAV Modular Assembly shall be configured with software tools that provide a simple Question/Answer format for developing applications and downloading.

u. Sensor Support.

1) The VMA shall support an LCD display room sensor.
2) The VMA shall also support standard room sensors as defined by analog input requirements.
3) The VMA shall support humidity sensors defined by the AI side loop.

2. Air Handling Unit (AHU) Controllers:

a. AHU controllers shall support, but not be limited to the following configurations of systems to address current requirements as described in the "Execution" portion of this specification and for future expansion: Mixed Air-Single Path Generic Point Multi-plexing.
b. AHU controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.
c. AHU controllers shall have a library of control routines and program logic to perform the Sequence of Operation specified in the "Execution" portion of this specification.
d. Continuous Zone Temperature Histories: Each AHU Controller shall automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.
e. Alarm Management: Each AHU controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2.7 OPERATOR INTERFACE

A. Dynamic Graphic Displays: Graphic system schematics for each new piece of Mechanical equipment, including air handling units, rooftop units, terminal units, VAV, boilers, pumps, etc. shall be provided as specified in the Execution portion of this specification to optimize

system performance analysis and speed alarm recognition. Graphics shall be provided to the same level of complexity as other equipment and systems within the current BAS.

1. System Selection/Penetration. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.
2. Dynamic Data Displays: Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

B. System Configuration and Definition: All new temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

1. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform control/programming functions.
2. Programming Description: Definition of operator device characteristics, ASCs, individual points, applications and control sequences shall be performed through fill-in-the-blank templates.

    a. Network-Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single ASC, but shall be able to include data from any and all other ASCs to allow the development of network-wide control strategies.

3. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hardcopy printouts of all configuration and application data.
4. Data Base Save/Restore/Back-Up: Back-up copies of all ASC and Digital Panel data bases shall be stored in at least one personal computer or lap-top. Users shall also have the ability to manually execute downloads of an ASC or Digital Panel data base.

2.8 SENSORS AND INSTRUMENTATION DEVICES

A. Transmitters.

1. The electrical output of a transmitter shall be 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps for analog variables and binary contacts for status variables.
2. The resolution of a transmitter may not exceed the following:

    a. 0.01 Volts per increment for 0-10 VDC transmitters.
    b. 0.02 Milliamps per increment for 4-12 or 0-20 milliamp transmitters.
    c. The process variable change that corresponds to the transmitter resolution is the smallest reportable change that can be processed.

3. Transmitters that connect directly to the FT-10A field bus are considered to be application specific devices.

B. Temperature Sensors.

1. Temperature sensors shall be resistance element detector (RTD) type or sealed element thermistor type.
2. Space temperature sensors shall match existing sensors be provided with blank covers with no exposed setpoints or setpoint adjustment.
3. Duct temperature sensors shall be rigid stem or averaging type as required for the application. All mixed air and discharge air temperature sensors shall be of the remote bulb type.
4. Water temperature sensors shall be provided with a separable copper, monel or stainless steel well.
5. Existing outside air temperature sensor is for global use.
6. Temperature sensors may be transmitters or thermistors as long as all performance requirements are met.
7. RTDs shall only be used with transmitter based sensors. They shall not be wired directly to a controller.
8. Conditioned Space Temperature Sensors.

    a. Operating Range: 50 to 86°F.
    b. Conformity: +/- 1 degree F over the specified operating range.

9. Duct Temperature Sensors.

    a. Operating Range: 40 to 140°F.
    b. Conformity: +/- 2 degrees F.

10. Heating Hot Water.

    a. Operating Range: 70 to 250°F.
    b. Conformity: +/- 2 degrees F.

C. Point Temperature Sensors.

1. Shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper.

D. Thermowells.

1. Thermowells shall be series 300 threaded stainless steel.
2. Inside diameter and insertion length shall be as required for the application.

E. Relative Humidity Sensors.

1. Shall use bulk polymer, resistive or thin film capacitive type, non-saturating sensing elements capable of withstanding a saturated condition without permanently affecting calibration or sustaining damage.
2. Shall include removable protective membrane filters.
3. For exterior installations, the sensors shall manage below freezing temperatures and direct contact with moisture without affecting sensor calibration.
4. For indoor installations, the sensor calibration shall not be altered by exposure to a condensing air stream.

5. The sensors shall be of the wall mounted or duct mounted type as required by the application and shall be furnished will all accessories for a complete and functional installation.
6. Sensors used in duct high limit applications shall use a bulk polymer resistive sensing element.
7. Duct mounted sensors shall be equipped with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage.
8. Operating Range: 0 to 100% relative humidity.
9. Conformity: +/- 2 % relative humidity.
10. Environmental Range: 25 to 140°F.

F. Differential Pressure Sensors.

1. Static pressure and air flow analog sensors shall be provided complete with flow element and shall be solid state precision industrial type with stainless steel meter body. Maximum error of no more than 1.0 percent of full span. Installation to be in strict accordance with the manufacturer's instructions, complete with three-way valve manifold for calibration and maintenance.
2. The operating range shall be as required by the application.
3. The over pressure rating shall be 150% of the highest design pressure to either input.
4. Conformity: +/- 2% of the operating range.

G. Differential Pressure Switches.

1. Shall have a user adjustable setpoint.
2. The differential may be fixed or adjustable but must meet the requirements of the sequence of control.
3. The range shall be such that the set point does not reside in the lower or upper quarter of the range.

    a. Shall have two sets of contacts with each contact having a rating greater than the connected load.
    b. One contact shall close on a rise above the differential and the other contact shall close on a fall below the differential.

H. Thermostats.

1. Line Voltage Thermostats:

    a. Integral manual On/Off/Auto selector switch, single or two-pole.
    b. Dead band: Maximum 2°F.
    c. Load Motor capacity rating.

2. Room Thermostat Accessories:

    a. Thermostat Covers: PVC.
    b. Insulating Bases: For thermostats located on exterior walls.
    c. Adjusting Key: Matching device.

3. Outdoor Reset Thermostat: Existing global data.

a. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
b. Scale range: -10 to 70°F.

4. Immersion Thermostat: Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.
5. Air-stream Thermostats:

a. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
b. Averaging service remote bulb element: 20 feet.

6. Electric Low Limit Duct Thermostat:

a. Snap acting, single pole, single throw, manual reset switch tripping when temperature sensed across any 12 inches of bulb length is equal to or below setpoint.
b. Bulb length: Minimum 20 feet.
c. Furnish one thermostat for every 20 sq. ft of coil surface.

7. Electric High Limit Duct Thermostat:

a. Snap acting, single pole, single throw, automatic reset switch tripping when temperature sensed across any 12 inches of bulb length is equal to or above setpoint.
b. Bulb length: Minimum 20 feet.
c. Furnish one thermostat for every 20 sq. ft of coil surface.

8. Fire Thermostats:

a. UL labeled, factory set in accordance with NFPA 90A.
b. Normally closed contacts, manual reset.

I. Flow Nozzles.

1. Flow nozzles shall be made of austenitic stainless steel with an accuracy of +/- 1% of full flow.
2. The inlet nozzle form shall be elliptical and the nozzle throat shall be the quadrant of an ellipse. The thickness of the nozzle wall and flange shall be such that distortion of the nozzle throat from strains caused by the pipeline temperature and pressure, flange bolting, or other methods of installing the nozzle in the pipeline shall not cause the accuracy to degrade beyond the specified limit.
3. The outside diameter of the nozzle flange or the design of the flange facing shall be such that the nozzle throat shall be centered accurately in the pipe.

J. Venturi Tubes.

1. Venturi tubes shall be made of cast iron or cast steel and shall have an accuracy of +/- 1% of full flow.
2. The throat section shall be lined with austenitic stainless steel. Thermal expansion characteristics of the lining shall be the same as that of the throat casting material. The

surface of the throat lining shall be machined to a +/- 50 micro-inch finish, including the short curvature leading from the converging section into the throat.

K. Annular Pitot Tubes.

1. Annular pitot tubes shall be averaging type differential pressure sensors with four total head pressure ports and on static port made of austenitic stainless steel. The sensor shall have an accuracy of +/- 2% of full flow and a repeatability of +/- 0.5% of the measured value.

L. Flow Switches.

1. Flow switches shall have a repetitive accuracy of +/-10% of actual flow setting. Switch actuation shall be adjustable over the operating flow range. The switch shall have Form C snap-action contacts, rated for the application.
2. The flow switch shall have non flexible paddle with magnetically actuated contacts and be rated for service at a pressure greater than the installed conditions.

M. Current Transducers.

1. Current transducers shall accept an AC current input and shall have an accuracy of +/- 2% of full scale.
2. An integral power supply shall be provided for the analog output signal if required. The device shall have a means for calibration.

N. Current Sensing Relays.

1. Current sensing relays (CSRs) shall provide a normally-open contact with a voltage and amperage rating greater than its connected load. Current sensing relays shall be of split-core design.
2. The CSR shall be rated for operation at 200% of the connected load. Voltage isolation shall be a minimum of 600-volts. The CSR shall auto-calibrate to the connected load.

O. Voltage Transducers.

1. Voltage transducers shall accept an AC voltage input and have an accuracy of +/-0.25% of full scale.
2. An integral power supply shall be provided if required for the analog output signal. The device shall have a means for calibration. Line side fuses for transducer protection shall be provided.

P. Occupancy Sensors.

1. Occupancy sensors shall have occupancy-sensing sensitivity adjustment and an adjustable off-delay timer with a range encompassing 30 seconds to 15 minutes. Occupancy sensors shall be rated for operation in ambient air temperatures ranging from 50°F to 104°F or temperatures normally encountered in the installed location. Sensors integral to wall mount on-off light switches shall have an auto-off switch. Wall switch sensors shall be decorator style and shall fit behind a standard decorator type wall plate. All occupancy sensors, power packs, and slave packs shall be UL listed. In addition to

any outputs required for lighting control, the occupancy sensor shall provide a contact output rated at 1A at 24 VAC or a SNVT output.

2. Passive Infrared Occupancy Sensors: PIR occupancy sensors shall have a multi-level, multi-segmented viewing lens and a conical field of view with a viewing angle of 180 degrees and a detection of at least 6 meters (20 feet) unless otherwise shown or specified. PIR Sensors shall provide field-adjustable background light-level adjustment with an adjustment range suitable to the light level in the sensed area, room, or space. PIR sensors shall be immune to false triggering from RFI and EMI.
3. Ultrasonic Occupancy Sensors: Ultrasonic sensors shall operate at a minimum frequency 32 kHz and shall be designed to not interfere with hearing aids. Dual-Technology Occupancy Sensor (PIR and Ultrasonic) Dual-Technology Occupancy Sensors shall meet the requirements of both PIR and Ultrasonic Occupancy Sensor.
4. Dew Point Sensor.

    a. Sensor shall be suitable for measurement of dew point from -40 to +80 °F over a pressure range of 0 to 150 psig. The transmitter shall provide both dry bulb and dew point temperatures on separate outputs.
    b. The end to end accuracy of the dew point shall be +/-5°F and the dry bulb shall be +/-1°F. Sensor shall be automatic zeroing and shall require no normal maintenance or periodic recalibration.

Q. Temperature Switches.

1. Duct Mounted Low Limit Safety Switch. Duct mount temperature low limit switches (freezestats) shall be manual reset, low temperature safety switches with a minimum element length of 1 foot per square-foot of coverage which shall respond to the coldest 18 inch segment with an accuracy of 3.6°F. The switch shall have a field-adjustable set point with a range of at least +30 to +50°F. The switch shall have two sets of contacts, and each contact shall have a rating greater than its connected load. Contacts shall open or close upon drop of temperature below set point as shown and shall remain in this state until reset.
2. Pipe Mounted Limit Switch.

    a. Pipe mount temperature limit switches (aquastats) shall have a field adjustable set point between 60 to 90°F, an accuracy of +/- 3.6°F) and a 10°F fixed dead band.
    b. The switch shall have two sets of contacts, and each contact shall have a rating greater than its connected load. Contacts shall open or close upon change of temperature above or below set point as shown.

R. Damper End Switches.

1. Each end switch shall be a hermetically sealed switch with a trip lever and over-travel mechanism.
2. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

S. Combination Carbon Dioxide (CO2) and Temperature Sensor:

1. Infrared and maintenance-free carbon dioxide transmitter for installation on indoor walls.

2. Measures the carbon dioxide concentration in the ambient air, up to 2,000 ppm, and transforms the data into a 0-10V or 0-5V output signal.
3. Equip with passive temperature elements selectable at 1.8 kohm or 10 kohm.
4. Response time is less than three (3) minutes.
5. Utilizes non-dispersive infrared (NDIR) with diffusion sampling.
6. Accuracy of ±1% of measurement range and ±5% of measured value and ±10 ppm annual drift.
7. Temperature Sensor:

    a. Operating Range at -40°F to 158°F.
    b. Output Signal at 0-10V. or 0 - 5V.
    c. Accuracy of ± 1.4°F at 77°F.

T. Thermostat and Sensor Guards.

1. BAPI-GUARD, or approved equal manufacturer prior to bidding, for protection from tampering, adjustment and physical damage.
2. Constructed of thick, durable polycarbonate with:

    a. Key lock.
    b. Low profile, compact design.
    c. Suitable for horizontal or vertical mounting.

U. Carbon Dioxide Sensor.

1. Veris #OWL and CDL CO2, RH and Temperature sensing all in one unit including the following features:

    a. 5-year calibration interval.
    b. Low ambient sensitivity.
    c. Field-selectable outputs.
    d. Integrated transducer and probe.
    e. 4-20mA analog output.
    f. 32° to 122°F CO2, operating range.
    g. 0-2000 ppm CO2 range.
    h. 2% plus or minus CO2 accuracy.
    i. 0-100% RH range with ± 0.1% accuracy.
    j. 50°-95° RH and temperature operating range.
    k. 1°F ± accuracy.

V. Insertion Turbine Flowmeters.

1. Veris Industries SDI-Series is standard of design.
2. Insertion Turbine Flowmeter accuracy shall be +/-1% of reading for a minimum turndown ration of 1:1 through a maximum turndown ratio of 50:1. Repeatability shall be +/-0.25% of reading. The meter flow sensing element shall operate over a range suitable for the installed location with a pressure loss limited to 1% of operating pressure at maximum flow rate.
3. Design of the flowmeter probe assembly shall incorporate integral flow, temperature and pressure sensors.

4. The turbine rotor assembly shall be constructed of Series 300 stainless steel and use teflon seals.

W. Carbon Monoxide/Nitrogen Dioxide Sensor.

1. Refer to specification section 230915 for requirements.

2.9 OUTPUT DEVICES, VALVES AND DAMPERS

A. Output Devices.

1. Output Devices as Application Specific Devices.

a. Output Devices that receive commands as network variables are considered to be application specific devices.
b. These devices shall meet the requirements specified previously for application specific devices.

2. Actuators.

a. Actuators shall be electric (electronic).
b. Electric actuators shall have an electronic cut off or other means to provide burnout protection if stalled. Actuators shall have a visible position indicator.
c. Electric actuators shall provide position feedback to the controller as shown. Actuators shall smoothly open or close the devices to which they are applied.
d. Electric actuators shall have a full stroke response time in both directions of 90 seconds or less at rated load.
e. Where multiple electric actuators operate from a common signal, the actuators shall provide an output signal identical to its input signal to the additional devices.
f. Positive Positioning Devices: Positive positioning devices shall be a relay with a mechanical position feedback mechanism and an adjustable operating range and starting point.

3. Electronic Damper Actuators.

a. Electronic damper actuators shall be direct shaft mount.
b. Dampers and modulating or two-position actuators shall be provided as required by the Sequence of Operations. Damper sections shall be sized based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the Sequences of Operations. All actuators shall have external adjustable stops to limit the travel in either direction and a gear release to allow manual positioning.
c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in Sequence of Operations as "quick acting", shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

4. Electronic Valve Actuators.

a. Electronic valve actuators shall be manufactured by the valve manufacturer.
b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.
c. Modulating and two-position actuators shall be provided as required by the Sequence of Operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
d. Modulating actuators shall be UL listed and accept 24 VAC or VDC and 120 VAC power. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
e. Two-position or open/closed actuators shall be UL listed and accept 24 or 120 VAC power supply. Butterfly isolation and other valves, as specified in the Sequence of Operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump.

5. Relays.

a. Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts enclosed in a dust proof enclosure. Each set of contacts shall incorporate a normally open (NO), normally closed (NC) and common contact.
b. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage.

6. Automatic Control Valves.

a. General.

1) Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall meet ANSI/ASME B16.34 or ANSI/ASME B16.15 pressure and temperature class ratings based on the

design operating temperature and 150% of the system design operating pressure.

2) Unless otherwise specified or shown, valve leakage shall meet ANSI/FCI 70-2 Class IV leakage rating (0.01% of valve Kv). Unless otherwise specified or shown, valves shall have globe-style bodies.
3) Unless otherwise specified the following applies:

    a) Bodies for valves 1.5 inches and smaller shall be brass or bronze, with threaded or union ends.
    b) Bodies for 2 inch valves shall have threaded ends.
    c) Bodies for valves 2 to 3 inches shall be of brass, bronze, or iron.
    d) Bodies for valves 2.5 inches and larger shall be provided with flanged-end connections.
    e) For modulating applications, the valve coefficient shall be within 100% to 125% of valve coefficient shown.
    f) For two position applications, where the two positions are full open and full closed, the valve coefficient shall be the largest available for the valve size.
    g) Valve and actuator combinations shall be normally open or normally closed as shown.

b. Ball Valves.

1) Balls shall be stainless steel.
2) Valves shall have blow-out proof stems.

c. Butterfly Valves.

1) Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and non-corrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from -20 to +250°F.
2) The rated flow coefficient for butterfly valves shall be the value at 70% (60 degrees) open position.
3) Valve leakage shall meet ANSI/FCI 70-2 Class VI leakage rating.

d. Two-Way Valves.

1) Two-way modulating valves used for liquids shall have an equal-percentage characteristic.

e. Three-Way Valves:

1) Three-way modulating valves shall provide equal percentage flow control with constant total flow throughout full plug travel.

f. Hydronic System Control Valves:

1) All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe

open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the Sequence of Operations. All control valves shall be sized by the control manufacturer and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.).

2) Hot water control valves shall be modulating ball valves or butterfly, if required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable volume or constant air handling unit or rooftop unit coils shall be sized for a pressure drop of 4 PSI.
3) Ball valves shall be used for hot water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units and fan coil units except those described hereinafter.
4) Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In-line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane. Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.
5) All valves shall have modified linear characteristics.

7. Control Dampers.

a. The BAS Contractor shall furnish all automatic dampers other than those included within packaged equipment such as rooftop units. All automatic dampers shall be sized for the application by the BAS Contractor or as specifically indicated on the Drawing.
b. Damper Assembly.

1) A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger damper sizes shall be made from a combination of sections.
2) Dampers shall be steel or other materials where shown. Flat blades shall be made rigid by folding the edges.
3) Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream.
4) Damper axles shall be 0.5 inches minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.
5) Pressure drop through dampers shall not exceed 0.04 inches water gauge at 1,000 ft/min in the wide-open position.
6) Frames shall not be less than 2 inches wide.
7) Dampers shall be tested in accordance with AMCA 500-D.

c. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
d. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
e. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16 gauge minimum hot-dipped channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed again, 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
f. Pressure drop through dampers shall not exceed 0.04 inches water gauge at 1000 ft/min. in wide open position.
g. Operating Linkages.

8. Operating links external to dampers, such as crank arms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least 300% of the maximum required damper operating force.
9. Rod lengths shall be adjustable.
10. Links shall be brass, bronze, zinc-coated steel, or stainless steel.
11. Working parts of joints and clevises shall be brass, bronze, or stainless steel.
12. Adjustments of crank arms shall control the open and closed positions of dampers.

a. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5” w.g., but no more than 4000 FPM or 6”w.g. Acceptable manufacturers are Johnson Controls D-7250, D-1250 or D-1300, Ruskin CD60 and Vent Products 5650.

2.10 AIR FLOW/TEMPERATURE MEASUREMENT

A. Manufacturers:

1. Ebtron - Gold Series Models.
2. Air Monitor Corp.
3. Or approved equal prior to bidding.

B. Air Flow Measurement Device Location.

1. Refer to controls schematics.

C. Air Flow/Temperature Measurement - General.

1. This information is provided for reference by the BAS Contractor and Mechanical Contractors. Refer to plans for clarification on who is responsible for providing the air flow measuring equipment. Some of the units are provided loose for field-installation (by

BAS Contractor) and some are provided factory-installed as part of the mechanical unit assembly.

2. The BAS Contractor shall verify the compatibility of the selected device with the intended airflow measuring application.
3. The air flow/temperature measurement station (AFTMS) indicated on the plans shall be capable of monitoring air flow and temperature rates at each measurement location. Sensors shall use thermal dispersion technology with two “bead in glass”, hermetically sealed thermistor probes at each measurement point. The system shall be factory tested prior to shipment and not require calibration or adjustment over the life of the equipment when installed in accordance to manufacturer’s guidelines. Each sensor probe shall be provided with a UL plenum-rated connecting cable with circular terminal connectors and gold plated contacts. Connecting cable shall be a minimum of 10 feet in length (up to 50 feet) for each probe as required for mounting in location with proper ambient conditions. Sensor probes shall be “plug and play” design and do not have to be matched to a specific transmitter. All sensor calibration data shall be stored in the sensor probe. No additional devices or transducers shall be required to interface with the host controls.
4. Sensors shall be factory-calibrated at 16 air flow rates and 3 temperatures to NIST-traceable standards for both airflow and temperature. Each sensing point shall independently measure airflow and temperature prior to averaging. Installed accuracy shall be percent of reading and demonstrated at both maximum and minimum air flow rates for each measurement location.

D. Duct and Plenum Mounted Sensor Probes.

1. Sensor probes shall be constructed of gold anodized aluminum alloy tube with 303 stainless steel mounting brackets. Probes shall be constructed as insertion, internal, or standoff mounting, depending on the installation requirements.
2. Probe Performance Requirements: the sensor accuracy for airflow shall be at least 2% of Reading over the sensor probe operating ranges. The installed total accuracy for airflow shall be better than □3% of Reading over the sensor probe operating ranges when installed in accordance with manufactures’ guidelines. The sensor accuracy for temperature shall be better than □0.15°F over the entire operating range.
3. Probe Sensor Density: The number of independent sensing points shall be as indicated below:

    a. Sensors.

        1) < = 1 2.
        2) >1 to <4 4.
        3) 4 to <8 6.
        4) 8 to <12 8.
        5) 12 to <16 12.
        6) > = 16 16.

4. Probe Operating Ranges”.

    a. Airflow: 0 to 5,000 FPM.
    b. Temperature: -20°F to +160°F.
    c. Relative Humidity: 0 to 99% (non-condensing).

E. Fan Inlet Velocity Sensors.

1. Sensors shall be constructed with stainless steel sensor bodies, stainless steel mounting brackets and with adjustable cadmium-plated mounting rods.
2. Fan Inlet Performance Requirements: The individual sensor accuracy for airflow shall be better than 3% of reading over the sensor probe operating ranges when installed in accordance with manufacturers' guidelines. The installed accuracy for temperature shall be better than 0.15°F over the entire operating range.
3. Fan Inlet Sensor Density: Probes shall be provided with an adjustable mounting, and two sensors per inlet, for single or dual inlet fans.
4. Fan Inlet Sensor Operating Ranges:

    a. Airflow: 0 to 10,000 FPM.
    b. Temperature: -20°F to +160°F.
    c. Relative Humidity: 0 to 99% (non-condensing).

PART 3 EXECUTION

3.1 INSTALLATION

A. BAS Wiring.

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of the applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAs Contractor, the Contractor shall be responsible for all costs incurred in correcting and/or replacing the selected components.
4. Class 2 Wiring.

    a. All Class 2 (24VAc or less) wiring shall be installed in conduit unless otherwise specified.
    b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment in order to ensure system integrity and operation.

    a. Provide grounding cabling and conduit at the panel terminations. Avoid grounding loops.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Division 01.

B. Start-up and commission system extension. Allow for start-up time and commissioning prior to placing control systems in permanent operation. When installation is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Provide a cross-check of each control point within the system by making a comparison between the command and the field controller device. Verify calibration of each field temperature sensor with a hand-held calibrated digital thermometer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Submit the results of functional and diagnostic tests and calibrations to the Owner/Engineer for the final acceptance. Provide test ports of sufficient size adjacent to all sensors and seal with removable plugs.

C. Compliance Inspection Checklist: Submit in the form requested, the following items of information to the Owner’s Representative and Engineer for verification of compliance to the project specifications. The Owner’s Representative, Commissioning Agent and Engineer will initial and date the checklist to signify Contractor’s compliance before acceptance of system.

1. Manually generate an alarm at each remote panel to demonstrate the capability of the on-site central computer to receive alarms within five (5) seconds.
2. Disconnect one (1) remote panel from the network to demonstrate that a single device failure shall not disrupt or halt communication. Panel to be disconnected will be selected by the Engineer.
3. At remote panel of choice, demonstrate the ability to display on the existing Portable Operator's Terminal (POT);

    a. At least one (1) temperature setpoint and at least one (1) status condition; i.e. on or off for a system or piece of equipment attached to that panel as well as for points on another remote panel on the network.
    b. The diagnostic results as specified for a system or piece of equipment attached to that panel, as well as a system or piece of equipment attached to another remote panel.

D. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for one day period.

E. Provide basic operator training for the system extension on data display, alarm and status descriptors, requesting data, execution of commands and request of logs.

F. The contractor shall provide three (3) bound copies of an owner's manual describing all operating and preventative maintenance service procedures to be used with the system.

3.3 ACCEPTANCE TESTING

A. After the installation is complete and proper operation has been demonstrated, a 60-day acceptance test shall begin. The entire system shall be required to operate for 60 days with no malfunctions - field repairable malfunctions accepted. Any malfunction during the 60-day test which cannot be corrected with 24 hours by the supplier shall be considered a non-field repairable malfunction and, after repairs are complete, the test shall be repeated.

B. The acceptance test shall apply to all equipment furnished under this section.

C. Substantial completion may be obtained prior to starting the acceptance test.

D. Final completion shall not be considered prior to successful completion of the acceptance test.

3.4 PATCHING AND REPAIR

A. Provide patching and repair at walls where existing control devices are demolished as part of the project scope. Scope of repairs may include wall finish repair, painting and the installation of blank plates over existing openings as required.

3.5 AIR FLOW MEASURING SCHEDULE

A. UNIT # OA SA RA/EXH PROVIDED BY.

B. RTU-3 YES NO NO Pkgd. With unit.

C. RTU-4 YES NO NO Pkgd. with unit.

D. RTU-5 YES YES NO Pkgd. with unit.

E. RTU-6 YES YES NO Pkgd. with unit.

F. RTU-7 YES YES NO Pkgd. with unit.

G. RTU-8 YES YES NO Pkgd. with unit.

3.6 INPUT/OUTPUT SCHEDULE - ON PLANS

END OF SECTION

SECTION 230933 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes variable frequency controllers provided and installed by BAS Sub-Contractor and also VFD's provided within packaged equipment. Power wiring connections provided by Division 26.

B. Related Sections:

1. Section 230900 through 230993 - Building Automation System.
2. Section 262813 - Fuses.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000-Volts Maximum).
2. NEMA FU 1 - Low-Voltage Cartridge Fuses.
3. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
4. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

C. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions and enclosure details.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB.

B. Schneider Electric.

C. Substitutions: Under provisions of Division 01.

2.2 DESCRIPTION

A. Provide enclosed variable frequency controllers suitable for operating the indicated loads. Conform to requirements of NEMA ICS 3.1.

2.3 RATINGS

A. Rated Input Voltage: 208-volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 200-volts, three phase, 60 Hertz.

C. Operating Ambient: 0°C to 40°C.

D. Minimum Efficiency at Full Load: 97 percent.

2.4 DESIGN

A. Employ microprocessor based inverter logic isolated from power circuits. Unit to have 5% full DC buss choke or DC link reactor is acceptable.

B. Design for ability to operate controller with motor disconnected from output.

C. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

2.5 PRODUCT OPTIONS AND FEATURES

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for over-current, over-voltage, ground fault, over-temperature, and input power ON. Display of all functions, faults and programming shall be in the English language.

C. Volts Per Hertz Adjustment: Adjustable or microprocessor optimized.

D. Current Limit Adjustment: 60 - 110 percent of rated.

E. Acceleration Rate Adjustment: 0.1 - 30 minutes.

F. Deceleration Rate Adjustment: 0.1 - 30 minutes.

G. Provide HAND-OFF-AUTOMATIC and manual speed control buttons on removable keypad.

H. Input Signal: 0-10 V DC.

I. Safety Interlocks: Provide terminals for remote contact to inhibit starting under both manual and automatic mode.

J. Control Interlocks: Provide terminals for remote contact to allow starting in automatic mode.

K. Provide a fused disconnect built into the unit.

2.6 FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.

B. Enclosure: Suitable for location shown on plan or described in this section.

C. Finish: Manufacturer's standard enamel.

2.7 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 01.

B. Verify that surface is suitable for controller installation.

C. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.2 INSTALLATION

A. VFD provided and installed by equipment manufacturer as scheduled and described in Sequence of Operations.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Fuses: internal fuse block shall be provided within integral unit disconnect.

D. Provide engraved plastic nameplates under the provisions of Section 230553.

E. Installing Contractor or equipment manufacturer shall provide all necessary control wiring between drive and automation system. Refer to plan sheet schedules to confirm who will be providing VFD.

F. Drive shall be installed with a dedicated load side metallic conduit to the connected motor.

3.3 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage and grounding.

3.4 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems according to manufacturer’s recommendations.

B. Provide a written report for each VFD at the initial motor start-up.

3.5 ADJUSTING

A. Make final adjustments to installed drive to assure proper operation of fan or pump system. Obtain performance requirements from installer of driven loads.

3.6 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

3.7 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 230593.

B. Demonstrate operation of controllers in automatic and manual modes.

3.8 FACTORY START-UP

A. Certified factory start-up shall be provided for each drive by factory authorized personnel. 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.

3.9 POWER WIRING

A. The Division 26 Electrical Contractor Mechanical Contractor shall bring power to the frequency drive and shall run the power wiring from the drive to the associated motor.

B. Drives provided within a packaged unit shall have all power wiring to the drive and from the drive to the motor included without need for Division 26 contractor.

3.10 VFD SCHEDULE

A. Provide new variable frequency drive for the following list of equipment:

1. RTUs as scheduled.
2. Pumps as scheduled.
3. Fans as scheduled.

END OF SECTION

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SECTION 230993 - SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:

1. Single Zone Variable Volume Rooftop Units.
2. Variable Volume VAV Rooftop Unit.
3. Variable Volume Terminal Units.
4. Fin-Tube Radiation.
5. Propeller & Cabinet Unit Heaters.
6. Powered Roof Ventilator.
7. Boiler and Pump Control.
8. Boiler Room Ventilation.
9. Emergency Boiler Room Shut-Down.
10. Exhaust Fans.
11. Roof Intakes and Reliefs.
12. Destratification Fans.
13. Specialty Exhaust and MUA Equipment.

1.2 RELATED SECTIONS

A. Division 23 - Specification Index.

B. Section 230923 - Direct Digital Control Systems.

C. Section 23 033 - Variable Frequency Controllers.

D. Section 238103 - Packaged Rooftop Unit Controls.

E. Section 235122 - Condensing Boilers.

F. Refer to Mechanical Plan Sheet Schedules for dampers, valves, and other equipment quantities.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.

1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.

2. Submit flow diagrams for each control system, graphically depicting control logic.
3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
4. Coordinate submittals with information requested in Section 230900 and 230923.

C. Submit diagrams indicating mechanical system controlled and control system components. Label with settings, adjustable range of control and limits. Include written description of control sequence and flow diagrams for each control system.

1.5 CLOSEOUT SUBMITTALS

A. Division 01- Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.PRODUCTS.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Temperature Control Plan Sheets for Control Diagrams, Sequence of Operations and Points Lists.

B. Refer to equipment schedules and standard details for valve and actuator requirements.

END OF SECTION

SECTION 232113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heating water/glycol piping, above ground.
2. Equipment drains and over flows.
3. Unions and flanges.
4. Pipe hangers and supports.
5. Valves.

B. Related Sections:

1. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
2. Division 09 - Painting and Coating: Product requirements Painting for placement by this section.
3. Section 230516 - Expansion Fittings and Loops for HVAC Piping: Product and execution requirements for expansion compensation devices use in heating and cooling piping systems.
4. Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, and firestopping for placement by this section.
5. Section 230553 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
6. Section 230700 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
7. Section 232116 - Hydronic Piping Specialties: Product and execution requirements for piping specialties used in heating and cooling piping systems.
8. Section 232123 - Hydronic Pumps: Product and execution requirements for pumps used in heating and cooling piping systems.
9. Section 232150 - HVAC Water Treatment: Product and execution requirements for cleaning and chemical treatment of heating and cooling piping systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.4 - Gray Iron Threaded Fittings.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B31.1 - Power Piping.
6. ASME B31.9 - Building Services Piping.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A312 - Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel.
4. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM B32 - Standard Specification for Solder Metal.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
11. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
12. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
13. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
14. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
6. MSS SP 80 - Bronze Globe, Angle and Check Valves.
7. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
8. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
9. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, insure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Provide for access to flanges, union, and couplings.

B. Use of grooved mechanical couplings and fasteners is the Contractor's option. Note that additional costs for insulating joints shall be included by Contractor.

C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus. Unions are not required if a grooved piping system is utilized.

D. Provide pipe hangers and supports in accordance with Section 23 05 29.

E. Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Use globe, ball or butterfly valves for throttling, bypass, or manual flow control services.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

C. Test Reports: Indicate results of heating and plumbing piping system pressure test.

D. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

E. Welders' Certificate: Include welders' certification of compliance with ASME B31.9, ASME Section IX and AWS D1.1.

F. Grooved joint couplings and fittings shall be in compliance with ASME B31.4.

1.5 CLOSE OUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves, equipment and accessories.

C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

C. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

D. All castings used for coupling housings fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

1.11 WARRANTY

A. Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 HEATING WATER / GLYCOL PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.

1. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
2. Joints: Threaded for pipe 2 inch and smaller; welded or grooved Victaulic for pipe 2-1/2 inches and larger.

B. Steel Pipe: ASTM A53/A53M, Schedule 40, black rolled grooved ends. Victaulic or equal couplings.

1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, grooved ends.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.

a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, flexible type and compatible with steel piping sizes.
b. Gasket: Elastomer composition for operating temperature range from 86 °F to 200 °F.
c. Accessories: Grade 8 steel or stainless steel bolts, nuts, and washers.

C. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper and bronze.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535°F.
3. Viega Pro-Press copper connection.

D. Copper Tubing: ASTM B88, Type L K, hard drawn, rolled grooved ends.

1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.

a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
b. Gasket: Elastomer composition for operating temperature range from 86 °F to 200 °F.
c. Accessories: Grade 8 steel or stainless steel bolts, nuts, and washers.

E. As an alternative to soldering, Pro Press System by Ridgid/Viega, Nibco or Vic-Press may be used. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

F. Refer to Specifications Sections 232114 for PEXa piping options.

2.2 APPROVED MANUFACTURERS - GROOVED END COUPLINGS

A. Victaulic.

B. Grinnell.

C. Anvil-Gruvlok.

D. Approved equal manufacturer prior to bidding.

2.3 GROOVED END COUPLINGS

A. Housing Clamps: Ductile iron to engage and lock, designed to permit some angular deflection, contraction and expansion.

B. Rigid Type: Victaulic housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

1. 2" through 8": Installation-Ready couplings, designed for direct stab installation onto grooved end pipe without field disassembly, Grade "EHP" EPDM gasket rated to +250 deg F. Victaulic Style 107-Quick-Vic™.
2. Or Anvil Gruvlok 7401/7400.

C. Flexible Type: For use in locations where vibration attenuation and stress relief are required. A minimum of three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration.

1. 2" through 6": Installation-Ready 'stab-on' coupling. Victaulic Style 177-Quick-Vic with Grade "EHP" EPDM gasket.
2. Or Anvil Gruvlok 7001/7000.

D. Couplings for Grooved Copper Piping:

1. For copper tubing 2" through 8", coupling shall be "Installation Ready", stab on design for installation onto roll grooved copper tube without prior field disassembly and no loose parts. Housing shall be ductile iron ASTM A-536, cast with offsetting, angle-pattern bolt pads, coated with copper colored alkyd enamel, Grade "EHP" EPDM gasket. Victaulic Style 607 Quick-Vic™.
2. Or Anvil Gruvlok 7400/6400.

E. Sealing Gasket: C-shape, Quick-Vic™, or FlushSeal® design, elastomer composition for operating temperature range from -30°F up to 250°F.

F. All sealing lubricants shall be those manufactured and recommended by the coupling manufacturer. (No exceptions.).

G. Accessories: Steel bolts, nuts, and washers meeting ASTM - A-183.

2.4 EQUIPMENT DRAINS, OVERFLOWS AND CONDENSATE DRAINS

A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535°F.
3. Pro-Press copper connection.

B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material, for interior use.

1. Fittings: ASTM D2466, Schedule 40, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

C. ABS Pipe: ASTM D2680 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material for interior use.

1. Fittings: ABS, ASTM D2751.
2. Joints: ASTM D2235, solvent weld.

D. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized, for exterior use.

1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

2.5 UNIONS, FLANGE ADAPTERS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered brazed joints.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flange Adapters for Pipe 2" and Smaller:

1. Stainless Steel Piping: Austenitic stainless steel housing, Class 150, FF, Vic Press 304 connection, ASTM A312. Victaulic Style 565.

C. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges with full face gaskets or grooved fittings.

D. Flange Adapters for Pipe 2 Inches and Larger:

1. Steel Piping: Ductile iron, flat face to accommodate ANSI Class 125/150 flanged components. Victualic Style 741/W741 or 743 (ANSI Class 300) or Anvil Gruvlok 7012.
2. Copper Piping: Ductile iron coated with copper-colored enamel, flat faced to accommodate ANSI Class 125/150 flanged components. Victaulic Style 641.

2.6 GLOBE OR ANGLE VALVES

A. Up To and Including 2 Inches:

1. Manufacturers:

a. Crane - Model 1310.

b. Hammond - Model IB440/415.
c. Nibco - Model T/S 211.
d. Milwaukee Valve 502/150.
e. Kitz.

2. Bronze body, bronze trim, union bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder or threaded ends.

B. Over 2 Inches:

1. Manufacturers:

a. Crane - 351.
b. Hammond - IR-116.
c. Milwaukee Valve F2981M.
d. Nibco - Model F-718B.
e. Kitz.

2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.7 BALL VALVES

A. Up To and Including 2 Inches:

1. Manufacturers:

a. a) Apollo -77-140 Series (Design Standard).
b. Jamesbury.
c. Worcester.
d. Victaulic.
e. Anvil.
f. Nibco.
g. Watts.
h. Milwaukee.
i. Nexus.
j. Kitz.

2. Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded.
3. Forged Brass two piece body, stainless steel ball, TFE seats, standard port and threaded ends.
4. Forged Brass body, stainless steel ball, TFE seats, standard port and press-fit ends.

B. Over 2 Inches:

1. Manufacturers:

a. Conbraco - Model #87/88 Series (Design Standard).
b. Jamesbury.
c. Worcester.

d. Victaulic.
e. Anvil.
f. Nibco.
g. Watts.
h. Milwaukee.
i. Kitz.

2. Cast steel body, flanged, chrome plated steel ball, teflon seat and stuffing box seals, and lever handle, gear drive handwheel for sizes 10 and over.
3. Ductile Iron body, Two piece, Standard Port, chrome plated carbon steel ball, chrome plated carbon steel stem, PTFE seats, grooved ends, lever handle, gear operator, or power actuator. Victaulic Series 726.

2.8 BUTTERFLY VALVES

A. Manufacturers:

1. Victaulic - Model 300, Master Seal (2"-12") AGS-Vic-300 (14"-24").
2. Keystone - Model 100/239 (Design Standard).
3. Mueller.
4. Anvil-Gruvlok.
5. Nibco.
6. Dezurik.
7. Milwaukee 300 Series.
8. Kitz.
9. Conbraco.
10. Jamesbury.
11. Watts.

B. 2-1/2 inches and Larger: MSS SP 67, Class 150.

1. Body: Cast or ductile iron, lug or grooved ends, stainless steel stem, extended neck.
2. Disc: Nickel-plated ductile iron aluminum bronze or chrome plated ductile iron.
3. Disc Shaft and Pin: Stainless steel.
4. Seat: Resilient replaceable EPDM or Buna N.
5. Handle and Operator: Infinite position lever handle with memory stop.

C. 2 inches through 10 inches: 150 psi at 73°F water temperature, maximum service temperature of 240°F, two piece body, ASTM D1784 PVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.

D. 2-1/2 inches through 6 inches: 300 psi, cast bronze body with copper-tube dimensioned grooved ends, EPDM coated ductile iron disc with integrally cast stem. Victaulic Series 608.

2.9 SWING CHECK VALVES

A. Up To and Including 2 Inches:

1. Manufacturers:

a. Crane - Model 34-1/2 N/A - 37/137 (Design Standard).
b. Hammond.
c. Apollo.
d. Miller.
e. Watts.
f. Nibco.
g. Milwaukee Valve.
h. Victaulic Valve.
i. Kitz.

2. Bronze body, bronze trim, bronze rotating swing disc, with composition disc and solder or threaded ends.

B. Over 2 Inches:

1. Manufacturers:

a. Crane - Model 373 (Design Standard).
b. Hammond.
c. Victaulic.
d. Gruvlok.
e. Nibco.
f. Milwaukee Valve.
g. Kitz.

2. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat and flanged ends.

2.10 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Hangers - B-Line.
2. Riser Clamps - B-Line.
3. Expansion Anchors - Hilti.
4. Power Driven Fasteners - Hilti.
5. Anvil International (Clamps and Hangers).
6. Carpenter & Paterson Inc.
7. Creative Systems Inc.
8. Flex-Weld, Inc.
9. Michigan Hanger Co.
10. Superior Valve Co.
11. Substitutions: Division 01 - Product Requirements.

B. Conform to ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69 and MSS SP 89.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel and split ring.

D. Hangers for Cold Pipe Sizes 2-1/2 inches and Larger: Carbon steel and adjustable clevis.

E. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel and adjustable clevis.

F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers, hanger rods and cast iron roller.

H. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

I. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.

J. Vertical Support: Steel riser clamp.

K. Copper Pipe Support: Carbon steel rings, adjustable and copper plated.

L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

M. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms. Size inserts to suit threaded hanger rod requirements.

N. Victaulic Style 107, 07 and W07 rigid couplings may be used on IPS steel piping systems, which meet the support and hanging requirements of ASME B31.1 and B31.9. An adequate number of Victaulic Style 177, 77 and W77 flexible couplings shall also be used to compensate for thermal expansion and/or contraction of the pipe.

2.11 PRESS FITTINGS

A. Press Fittings: Copper Pro-Press type fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-Rings for copper press fittings shall be EPDM.

B. Viega Pro-Press fittings shall be as manufactured by Ridgid Tool Co. Nibco, Apollo and Grinnell press systems shall be considered as approved equals.

C. Ball valves with Press Connections where Copper Press piping systems are allowed shall be Brass Body in accordance with ASTM B283 Alloy C37700 for fully annealed. Ball shall be Chrome-Plated Brass in Full Port design with a smooth cylindrical port in ball (no hollow balls allowed). Valve must mate with standard Copper Tubing L conforming to ASTM B88, assembled by tooling recommended by the Copper Press Fitting manufacturer. The Ball Valve must have factory installed O-rings furnished in EPDM material of type and size compliant with the Copper Press Fittings. The ball valve must be certified to NSF 61 and MSS SP110 in all applicable areas.

D. Quality Standard: Milwaukee UltraPress Model BA-480B, BA-490B or Apollo Xpress 77W Series up to 2".

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs and bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean and treat systems. Refer to Section 232150.

F. All new hydronic heating/cooling system piping must be pressure-tested at 1-1/2 times the maximum system design pressure, but not less than 100 PSI (hydrostatically) for15 minutes (minimum). New hydronic lines may not be placed into service until this testing is complete.

G. Hydronic pipes shall be installed so that the pipes can be drained and so that air can be completely removed from the system during filling.

3.3 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above, recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with IMC 305.4, ASME B31.and MSS SP 69.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Provide copper plated hangers and supports for copper piping.

I. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings in accordance with Section 230529.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install heating water piping in accordance with ASME B31.9.

B. Install non-conducting dielectric connections or install Victaulic wafer-type connections where jointing dissimilar metals.

C. Route piping parallel to building structure and maintain gradient.

D. Install piping to conserve building space and to not interfere with use of space by others.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.

G. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 230529.

H. Install pipe identification in accordance with Section 230553.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 230516.

J. Provide access where valves and fittings are not exposed. Mechanical Contractor shall provide access doors to the General Trades Contractor for installation in finished surface. Coordinate size and location of access doors with General Trades Contractor.

K. Slope hydronic piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe aligned.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

M. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting in exposed, finished areas.

N. Install valves with stems upright or horizontal, not inverted.

O. Provide condensate drain lines from all cooling coil drain pans (at indoor equipment) to the nearest floor drain. Minimum full size of drain connection with a deep seal trap and cleanout.

P. Provide galvanized steel condensate traps at all packaged rooftop equipment to avoid cracking possibilities of PVC, CPVC and ABS type fittings due to freezing conditions.

Q. Provide for multiple valves and fittings at all multiple coil banks in air handling units, packaged equipment and built-up systems. Verify quantity of coils in each bank with manufacturer.

R. Install drain pipe with 3/4" ball valve and capped hose connection at bases of vertical rises, low points of piping for each set of system area isolation valves and at all new and remodeled hydronic equipment including coils, boilers, chiller, convertors, tanks, cooling towers, etc. Provide teflon tape at threaded joint of pipe cap.

S. Grooved joints piping systems shall be installed in accordance with manufacturer's guidelines and recommendations. All couplings, fittings and valves shall be the product of the same manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review that contractor is following best recommended practices in grooved product installation.

    1. Note: A distributor’s representative is not considered to be qualified to conduct the training or job-site visits.

T. Vic Press 304™ Joints shall be installed in accordance with the manufacturers (Victaulic) guidelines and recommendations. Pipe shall be certified for use with the Vic Press 304™ system. Pipe shall be square cut, +/- 0.030", properly deburred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly. Use a Victaulic "PFT" series tool with the proper sized jaw for pressing.

3.6 DI-ELECTRIC FITTINGS

A. Di-electric fittings or Victaulic wafer-type connections shall be used when joining dissimilar materials.

3.7 PAINTING

A. None.

3.8 INSTALLATION, COPPER PRESS FIT FITTINGS

A. Press Connections: Copper Pro-Press type fittings shall be installed in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

B. Do not press uptight to a reheat coil, balancing valve, control valve or any piece of equipment or special fitting that may need to be replaced in the future. Install an adequate amount of straight copper tubing between fittings and devices for tool access during future maintenance or replacement activities.

3.9 PIPE SIZING AT CONTROL POINTS

A. Pipe sizing around control valves, bypass flow valves, flow measuring devices and at all coil connections shall be based on GPM flow and not on control valve or coil connection size. Size flow fitting to insure adequate P.D. at the device for accurate measurement.

3.10 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test heating water piping system in accordance with ASME B31.9 and/or ASME B31.1.

3.11 INSTALLATION OF BUILDING ZONE ISOLATION VALVES

A. The Contractor shall provide isolation valves throughout the system to isolate multiple zones of hydronic piping for ease of maintenance and draining of system areas. The minimum quantity required are shown on plans. Additional valves maybe added by contractor if deemed of value during construction at no additional cost to the Owner.

B. Each valve shall have a drain for each zone isolated with hose connection for controlled drain or recapture of system solution.

3.12 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

1. Refer to Section 230529.
2. Refer to manufacturer's recommendation for grooved end piping system support. Use the more stringent of the two requirements.

END OF SECTION

SECTION 232114 - HEPEXA HYDRONIC DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Hydronic branch piping (2" and smaller) may be installed with PEXa and shall include the following:

1. Cross-linked polyethylene (HePEXa) piping with oxygen barrier. Pipe fasteners as approved by the manufacturer of the HePEXa piping.
2. Provisions for expansion compensation as recommended and provided by the manufacturer as part of the Materials Package, along with drawing layout of expansion control devices as part of Shop Drawing submittal.
3. Supervision and field engineering required for the complete and proper function of the system.
4. Refer to Part 3.4 for location limitations.

1.2 RELATED SECTIONS

A. Section 232113 - Hydronic Piping.

B. Section 232116 - Hydronic Specialties.

1.3 REFERENCES

A. ASTM - American Society for testing and Materials.

1. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM F876, Standard Specification for Cross-linked Polyethylene (PEXA) Tubing.
3. ASTM F877, Standard Specification for Cross-linked Polyethylene (PEXA) Plastic Hot and Cold Water Distribution Systems.
4. ASTM F2014, Standard Specification for Non-Reinforced Extruded Tee Connections for Piping Applications.
5. ASTM F2080, Standard Specifiation for Cold-Expansion Fittings for Cross-Linked Polyethylene (PEXA) Pipe.

B. ISO - International ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

C. PPI - Plastic Pipe Institute.

1. PPI TR-3/2007, Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.

1.4 DEFINITIONS

A. Cross-linked polyethylene, commonly abbreviated PEXa, is made from high density polyethylene (HDPE). Cross-linking is accomplished during manufacturing. Cross-linking enhances the physical and mechanical properties of the polymer. The high-temperature properties are improved. Chemical resistance is enhanced by resisting dissolution. Low temperature properties are also improved; its impact and tensile strength, scratch resistance and resistance to brittle fracture are enhanced. The required degree of cross-linking, according to ASTM Standard F876, is between 70-89%. This specification requires PEXa to be designated as HePEXa and be manufactured by the high-pressure peroxide method with an oxygen barrier.

1.5 SUBMITTALS

A. Comply with Division 01, Submittal Procedures. Approval and/or acceptance of all submittals is required prior to fabrication.

B. Product Data: Submit manufacturer's Technical Manual, submittal forms, specifications and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.

1. Submit manufacturer's instructions for installation.
2. Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and galvanized support channel.
3. Coordinate required insulation size due to the support channel being inside the insulation perimeter.

C. Shop Drawings:

1. Indicate dimensions, descriptions of materials, general construction, component connections, anchorage methods, expansion compensation methods and support channel installation procedures.
2. Indicate critical dimensions, piping details and expansion compensation details.

D. Certification:

1. The design shall be reviewed and approved by a manufacturer's professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.
2. Fittings shall be third-party certified to applicable referenced standards as part of the manufacturer's HePEXa piping system, with independent listings from NSF.

E. Maintenance Instructions: Submit instructions for any maintenance required or recommended by manufacturer.

1.6 QUALITY ASSURANCE

A. Comply with Division 01 - Quality Assurance.

B. Manufacturer: Must be a company specializing in the work of this Section with a minimum of five years documented experience.

C. All components shall be supplied by one manufacturer.

D. Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.

E. Cross-linked polyethylene (HePEXa) pipe shall conform and be certified to ASTM F876 and F877. Fittings shall conform and be certified to ASTM F877 or F2080 and CSA B137.5. Pipes shall have an oxygen diffusion barrier shall conform to the requirements for oxygen permeability DIN 5726 and shall also have the PPI TR-3 listing.

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with Division 01 - Product Requirements.

B. Deliver and store piping and equipment in shipping containers with labeling in place.

1. Pipe shall be kept in original shipping boxes until required installation.

C. Store piping and equipment in a safe place, dry, enclosed cover, in a well-ventilated area.

1. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
2. Protect piping from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
3. Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.

D. Protect materials from damage by other trades.

E. Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.8 WARRANTY

A. Provide manufacturer’s standard written warranty.

1. The warranty shall include a minimum, provisions to repair defects from faulty materials or workmanship developed during the guarantee period, or provide for replacement with new materials, at no expense to Owner.
2. The heating pipe manufacturer shall warrant the cross-linked polyethylene (HePEXa) piping to be free from defects in material and workmanship for a period of twenty-five (25) years.
3. Cold-expansion compression-sleeve fittings shall be warranted to be free from defects in material and workmanship for a period of two (2) years starting at completion of successful pressurized water tests immediately following system installation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. REHAU.

B. Uponor.

C. Heat Link.

2.2 PIPING

A. Heating (hot water) and cooling (chilled water) pipe 2" and smaller may be high-density cross-linked polyethylene manufactured using the high-pressure peroxide method of Cross-linking (HePEXa). Pipe shall conform to ASTM F876 and ASTM F877.

B. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature and 80 psi gauge pressure at 200°F temperature.

C. HePEXa pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/(m2/d) @ 104°F water temperature, in accordance with DIN 4726.

D. Bend Radius:

1. The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.

E. Pipe to have a Flame Spread Index of less than 25 and a Smoke Developed Index of less than 50 when tested in accordance with ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada). In any case where the pipe does not conform to these standards, appropriate piping insulation shall be installed in order to meet the standard.

2.3 FITTINGS (ENGINEERED POLYMER)

A. Fittings shall be third-party certified to applicable standards ASTM F1807 as part of the manufacturer's HePEXA piping system, with independent listings from IAPMO, NSF, CSA and ICC, as applicable.

B. Fittings for PEX tube: ASTM F1807, EP-insert type with copper or stainless steel crimp rings and matching PEX tube dimensions.

C. Fittings shall provide maximum internal dimeter area for less pressure loss.

2.4 SUPPORTS

A. Unless noted otherwise, a galvanized steel channel, provided by the piping supplier, shall be provided for the straight runs of pipe.

B. When this channel system is used, the pipe support spacing shall be the same as steel and copper piping of the same size. Refer to Specification Section 230529.

C. For changes of direction, expansion loops and short branch pipe take-offs where the use of the channel isn't practical or possible, maximum hanger spacing shall be 32" O.C.

D. Pipe support clamp shall be a "Bismat 5000" with the spacer removed for anchoring the pipe or the spacer left in place to allow pipe movement.

2.5 INSULATION

A. The insulation type(s), thickness and vapor barrier requirements for hot water and chilled water, HePEXa piping shall be the same as for copper or steel piping. Refer to Specification Section 230700.

B. Coordinate insulation diameter needed to encapsulate the support channel and piping inside the insulation perimeter.

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of HePEXa heating distribution systems and they shall be appropriately licensed for the jurisdiction where the installation will take place.

3.2 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

B. Beginning of installation means acceptance of existing conditions and understanding of limitation in above ceiling spaces and mechanical room installation locations.

3.3 PREPARATION

A. Coordinate with related trades and manufacturer's recommendations with regard to installation in conjunction with materials in the same area.

B. Coordinate increased insulation size with insulating sub-contractor when allowances are included for PEXa piping equivalent that is larger than the pipe size noted on plans.

3.4 INSTALLATION

A. Install only in non-visible locations such as in walls, chases, soffits, tunnels and ceiling spaces. Note: Do not install in Mechanical Rooms.

B. Install in accordance with manufacturer's published installation manual and/or published guidelines and final shop drawings.

C. Route piping in an orderly manner, according to layout and spacing shown in final shop drawings. All installation notes shown on the drawings shall be followed.

D. At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts and join pipes immediately or cap ends of pipe to seal from contaminants.

E. Provide hangers, supports, anchors and expansion fittings as recommended by manufacturer and as shown on the Submittal Drawing.

3.5 FIELD QUALITY CONTROL

A. Filling, Testing and Balancing: Tests of hydronic heating systems shall comply with authorities having jurisdiction and where required. Tests shall be witnessed by the building official.

B. Pressure gauges used in testing and balancing shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.

C. Air Test:

1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
2. Do not exceed 150 psig.
3. Use liquid gas detector or soap solution to check for leakage at manifold connections.

D. Water Test:

1. Purge air from pipes.
2. Charge the completed, yet unconcealed pipes with water.
3. Take necessary precautions to prevent water from freezing.
4. Check the system for leakage, especially at all pipe joints.

E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure of 100 psig for 30 minutes.

1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum and there shall be no leakage.

F. After successfully performing the preliminary pressure test, perform the main pressure test immediately.

1. The test pressure shall be restored and continued as the main test for two (2) hours.
2. The main test pressure shall not fall more than 3 psig after two (2) hours.
3. No leakage shall be detected.

G. Complete inspection and furnish test reports supplied by the manufacturer of the system.

3.6 CLEANING

A. Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.

B. Comply with manufacturer's recommendations.

3.7 PROTECTION

A. Protect installation throughout construction process until date of final completion.

B. Replace components that cannot be repaired.

END OF SECTION

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SECTION 232116 - HYDRONIC PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressure gauges.
2. Pressure gauge taps.
3. Thermometers.
4. Test plugs. (Pete's Plug).
5. Bladder type expansion tanks.
6. Air vents.
7. Combination Air Separator/Sediment Removal/Hydraulic Separator.
8. Strainers.
9. Flow measuring and control.
10. Relief valves.
11. Pump suction fittings.
12. Combination (triple duty) pump discharge valves.
13. Flexible connectors for equipment.
14. Side stream filter.

B. Related Sections:

1. Section 232113 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.
2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
3. ASTM A536 - Standard Specifications for Ductile Iron Casting.

C. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 PERFORMANCE REQUIREMENTS

A. Flexible Connectors: Provide at or near pumps where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Manufacturer's data indicating use, operating range, total range, accuracy and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection and hookup configuration. Include pipe and accessory elevations.

D. Grooved joint components shall be shown on drawings and product submittals and shall be specifically identified with applicable style or series designation.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of actual locations of components, instrumentation and flow controls.

C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work and isolating parts of completed system until installation.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.8 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1. Trerice Co. - Model #620B is design standard.
2. Winter's.
3. Weiss Co.
4. Weksler Co.
5. Substitutions: Division 01 - Product Requirements.

B. Gauge: ASME B40.1, UL 393 and UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Fiberglass reinforced polypropylene.
2. Bourdon Tube: Type 316 stainless steel.
3. Dial Size: 4 inch.
4. Mid-Scale Accuracy: One percent.
5. Scale: PSI.

2.2 PRESSURE GAUGE TAPS

A. Manufacturers:

1. Trerice Co. - Model #872 is design standard.
2. Winter's.
3. Weiss Co.
4. Weksler Co.
5. Victaulic Co.
6. Substitutions: Division 01 - Product Requirements.

B. Ball Valve: Brass or Stainless Steel, 1/4 inch NPT for 250 psi. Standard of design is Apollo Model 70-140.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

D. Siphon: Steel, Schedule 40 Brass or Stainless Steel, 1/4 inch NPT angle or straight pattern.

E. Victaulic Style 923 Vic-Let 1/2" and 3/4" NPT on header 4 inch NPT strapless outlet with ductile iron housing, EPDM liner and hot rolled, oiled steel collar.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

1. H.O. Trerice Co. Model # BX9 is design standard.
2. Winter's.
3. Weiss Co.
4. Weksler Co.
5. Substitutions: Division 01 - Product Requirements.

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
4. Accuracy: 1%.
5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

C. Vic-O-Well Series 924: Ductile iron body with zinc plated hot rolled pickled and oiled steel collar and Grade "E" EPDM liner. Thermowell assembly with standard 11/4 inch extra fine thread and 6 inch nominal bulb length on 4 inch and larger header sizes rated for 300 psi provides a fast, easy connection combining Thermowell with strapless mechanical outlet. 3 inches of insertion length shall be provided.

2.5 TEST PLUGS

A. Manufacturers:

1. Pete's Plug.
2. Substitutions: Division 01 - Product Requirements.

B. 1/4 inch NPT or 1/2 inch NPT brass or stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:

1. Neoprene core for temperatures up to 200°F.
2. Nordel core for temperatures up to 350° F.
3. Viton core for temperatures up to 400°F.

C. Test Kit:

1. Carrying case, internally padded and fitted containing:

a. Two 3-1/2 inch diameter pressure gauges.

1) Scale range: 0 to 50 psi.

b. Two gauge adapters with 1/8 inch probes.
c. Two 1-1/2 inch dial thermometers.

1) Scale range: 0 to 250°F.

2.6 FLEXIBLE CONNECTORS FOR EQUIPMENT

A. Manufacturers:

1. Metraflex.
2. Mason.
3. Advanced Thermal.
4. Minnesota Flexible Co.
5. Flexonics.
6. Pathway.
7. Thermo-tech.
8. ADSCO.
9. Keflex.
10. Victaulic Co.
11. Anvil Gruvlok.
12. Twin Cities Hose.

B. Connector Sizes:

Connector Type	Size	Minimum Length
Stainless Steel	2-1/2"	12"
Stainless Steel	3"	14"
Stainless Steel	4"	16"
Stainless Steel	5"	18"
Stainless Steel	6"	20"

C. Three Victaulic Style 177 and Style 77 couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

D. Stainless steel Type 321 corrugated inner tubing with 321 stainless steel outer braiding and forged steel flanges. Maximum working pressure of 150 psig and 400°F max. working temperature.

2.7 BLADDER TYPE EXPANSION TANKS

A. Manufacturers:

1. ITT - Bell & Gossett.
2. Amtrol.
3. Armstrong.
4. Wend Mfg. Co.
5. TACO.

B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM bladder sealed into tank, and steel support stand.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 12 psig.

D. Cold Water Fill: Hose connection with ball valve isolation and cap.

E. Size: As shown on plan.

2.8 AIR VENTS

A. Manufacturers:

1. Spiro Vent.
2. ITT - Bell & Gossett.
3. Hoffman.
4. Vent Rite.
5. Dole.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.9 COMBINATION AIR SEPARATOR/SEDIMENT REMOVAL/HYDRAULIC SEPARATOR

A. Manufacturers.

1. Spirotherm - Spirovent Quad.
2. Taco - 5900 Series.
3. Wessels - PSAVR Series.
4. Approved equal manufacturer prior to bidding.

B. Furnish and install as shown on the Drawings a combination coalescing type air separator, sediment remover, hydraulic separator on hot and chilled water systems.

C. Unit shall be constructed of steel, rated for 150 psi design pressure and be selected at their peak point of efficiency in accordance with manufacturer's information. Unit shall be tested and stamped in accordance with Section 8D of ASME Code.

D. Entering velocity shall not exceed 4 feet per second.

E. Unit shall include an internal coalescing medium to reduce velocity, provide maximum air elimination and suppress turbulence.

F. Provide an integral high capacity float actuated air vent on the top fitting of the tank.

G. Unit shall have a bottom blow-down connection.

2.10 STRAINERS

A. Manufacturers.

1. Victaulic Co.
2. Anvil.
3. Spirex Sarco.
4. Hoffman.
5. Titan.
6. Metraflex.
7. Armstrong.
8. Illinois.
9. Watts.
10. Dunham Bush.
11. Hayward.
12. Metraflex.
13. Nexus-UY.
14. Kekley, Inc.

B. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. Size 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

E. Size 2 inch to 24 inch grooved end ductile iron body for 300 psig working pressure, Y pattern with 1/16 inch or 1/8 inch stainless steel perforated metal basket. Victualic Series 732/W732.

2.11 SIDE STREAM FILTER

A. Manufacturers.

1. Quantrol - QFP Series.
2. Pentek - ST-BC Series.
3. Twin City Hose.
4. Approved equal manufacturer prior to bidding.

B. Furnish and install a cartridge-style band-clamp side-stream filter housing connected to the hot water hydronic systems as shown on the plan details.

C. Unit shall be based on the following:

1. Housing: 304 Stainless steel construction with external poly-coat finish and support legs.
2. 150 PSI maximum pressure, 250°F maximum temperature.
3. Easy-access band clamp closure.
4. Compatible with double end (DOE) pleated cartridge filters.
5. Inlet and outlet shall be 2” MNPT.
6. Drain port, vent port and dirty/clean gauge ports.
7. Size unit for 30 GPM, Qty. (4) 10” filters.

D. Filters: Filters shall be string-wound type with initial 25 micron set and 10 micron set of polypropylene filtration media and a polypropylene core. Provide two extra sets of 25 micron filters and two sets of 10 micron for each filter housing.

E. Separator Construction.

1. The separator shall be fabricated of carbon steel with shell material and head material of 0.135 inch wall or better. Maximum operating pressure shall be 150 psi.
2. Paint coating shall be acrylic urethane.

2.12 PUMP SUCTION FITTINGS

A. Manufacturers:

1. Victaulic #731G.
2. ITT - Bell & Gossett.
3. Armstrong.
4. Flow Conditioning Corp.
5. Anvil Series #7250.
6. Central Grooved Piping.
7. TACO.

B. Fitting: Angle pattern, cast-iron body. Threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger. Rated for 175 psig working pressure, with inlet vanes, cylinder strainer 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream which is removable for cleaning.

C. Accessories: Adjustable foot support, blow-down tapping in bottom, gauge tapping in side.

D. Suction Diffuser: Ductile iron body, grooved inlet and flanged outlet, available from 3 inch to 12 inch, rated up to 300 psi, stainless steel diffuser with 16 mesh bronze start up prefilter and EPDM gasket. Suction diffuser is provided with a removable basket and a fine mesh sleeve which acts as a startup strainer and a pressure port is provided in the cap to measure the downstream pressure of the diffuser. Victaulic Style 731-I and W731-I (saddle type support is required, supplied by others).

2.13 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:

1. ITT - Bell & Gossett.
2. Victaulic Co.
3. Wheatley Mfg. Co.
4. Armstrong.
5. Anvil Series FTV.
6. TACO.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psig operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

C. Venture-check shall be used in lieu of the Series 716 check valve.

2.14 ACCEPTABLE MANUFACTURERS - HYDRONIC AND PLUMBING SYSTEMS FLOW METERS (VENTURI TYPE)

A. Flow Design, Inc.

B. Gerand Eng. Co. (Victaulic).

C. Tour & Andersson (Victaulic #733).

D. Nexus.

E. Bell & Gossett (MV Series.

F. TACO (Accu-Flo).

G. Pro Hydronics.

2.15 FLOW METERS FOR HYDRONIC AND PLUMBING SYSTEMS

A. Lines Sizes: 1/2" through 2-1/2."

1. Furnish and install brass bronze flow measuring element with balancing and shut-off(s). The flow element shall be of a low loss/high signal Venturi type with EQ \O(+,_)2 percent accuracy over a 10:1 rangeability. Each flow element shall be equipped with dual integral check (Shrader type) valve or pressure/temperature test plugs, complete with caps. Each element shall bear a permanent I.D. tag, with stamped or etched print, secured by a chain.
2. The balancing valve may serve in combination as the shut-off valve or be installed separately from the shut-off valve. If separately installed, the combination balancing/shut-off valves shall be made integral with the flow element to provide a one-piece assembly. This balancing valve shall be the ball type with large diameter plated ball, teflon seats, blow-out proof stem with teflon packing and packing nut, full size handle, grip and memory stop.
3. If installed separately, the balancing valve shall be located on the outlet side of the flow element in accordance with the manufacturer's requirements. This valve shall be a specially ported 300# rated bronze body butterfly valve with SS disc and viton seats, full size handle and grip, external lockable memory stop and with (without) optional pressure/temperature test port, union inlet or drain.

B. Line Sizes: 2-1/2" through 6."

1. Furnish and install Venturi or annular flow elements for each primary station where shown on plans and schedules. Elements shall be the same size as the diameter of the pipe. The elements shall come complete with Schrader type or needle shut-off valves and shall be capable of operating at 250° and 200 psig - 1379 kPa. Each element shall bear a permanent I.D. tag secured by a chain.
2. Venturi elements shall be constructed entirely of carbon steel (SS throat optional) and shall be of the low-loss design producing a permanent pressure loss of not more than six (6) percent of the differential pressure. Accuracy shall be within EQ \O(+,_)1 percent of a 10:1 range. The end connection shall be flanged, butt weld, NMPT or grooved.
3. Annular elements shall be of the self-averaging type with multiple dynamic pressure ports. These primary flow elements shall be made of 316LSS and shall be of the elliptical shape in order to ensure an accuracy of EQ \O(+,_)3/4 percent over a 17:1 turn-down ratio. Round, square and rectangular shapes shall not be accepted.

C. Provide (to the owner) a portable meter as manufactured by Preso Industries. It shall have a round 6" dial with a 270 deg. arc, and accuracy of EQ \O(+,_)1.34 F.S. or better. All wetted parts shall be of metal construction for longer life and to ensure accuracy. The meter body shall be of brass construction, the pressure sensing element of beryllium copper and all valves of brass. The meter shall be supplied complete, mounted in a durable impact resistant carrying case, including high and low purge valves, 2 hoses with quick connections compatible with the flow elements supplied, charts and operating instructions. Turn meter over to the owner after use during balancing. The meter shall have a dual capacity of 0 to 100 inches and 0 to 100 feet.

2.16 RELIEF VALVES

A. Manufacturers.

1. ITT - Bell & Gossett.
2. McDonnell & Miller.
3. Cash Acme.
4. Kunkle.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic direct pressure actuated, ASME certified capacity and label.

PART 3 EXECUTION

3.1 INSTALLATION - THERMOMETERS, GAUGES AND TEST PLUGS

A. Install one pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gauge.

B. Install gauge taps in piping.

C. Install pressure gauges with pulsation dampers. Provide ball valve to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

E. Install Pete’s Plug adjacent to controls systems thermostat, transmitter, or sensor sockets and where indicated on typical details.

F. Coil and conceal excess capillary on remote element instruments.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45° off vertical.

I. Adjust gauges and thermometers to final viewing angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A. Where large air quantities accumulate, provide enlarged air collection standpipes.

B. Install manual air vents at system high points.

C. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank. Support on pipe stand or from roof structure. Drain valve and pipe shall be same size as air separator bottom connection.

E. Provide drain and hose connection with a ball valve on strainer blow down connection.

F. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

G. Provide combination triple duty valve, on discharge side of base mounted centrifugal pump and as an option on large in-line pumps.

H. Support pump fittings with floor mounted pipe and flange supports.

I. Provide radiator-balancing valves on water outlet for the following terminal heating unit types: radiation, unit heaters, and fan coil units.

J. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

K. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

L. Pipe all relief valve outlets to within one foot of a floor drain and up to 12 inches above that floor drain so flow is conspicuous.

M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

N. Provide for multiple fittings and devices at all multiple coil banks in air handling units, packaged equipment and built-up systems. Verify quantity of coils in each bank with manufacturer.

O. In no case may a flow fitting be installed with the taps pointing down. All fittings must be installed with the flow taps facing up to horizontal.

P. Provide flexible stainless steel pipe connectors to isolate motor driven equipment such as pumps.

Q. Grooved joint piping specialties shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. All grooved piping specialties shall be the products of a single manufacturer. A victualic factory-trained field representative shall provide on-site training for contractor's field personnel in the installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

R. After substantial completion inspection and just before turning this equipment over to the owner, a new set of filters shall be installed in side stream filter unit and an extra set, for the first filter change by the owner, shall be stored in the Mechanical Room. The filters shall be labeled with the equipment served number they are intended for.

S. Locate strainers to allow easy access for maintenance. Do not locate strainers in close proximity to electric equipment (including light fixtures) where equipment damage could occur during strainer servicing.

T. Contractor Option: At the suction side of base mounted and close coupled pumps a Victaulic Series #381 piping package may be utilized. At the discharge side of base mounted and close coupled pumps a Victaulic Series #380 piping package may be utilized.

U. Provide a bypass loop to the side-stream filter as shown on plan diagrammatic with isolation valves for inlet and discharge piping.

3.3 SIDE STREAM FILTERS

A. Install filter tank on floor stands provided with unit.

B. Provide for full port isolation valves and a flow fitting to adjust flow capacity.

C. Use coarse 25-micron filter bags for first few changes and then switch to finer 5-micron filtering.

3.4 FIELD QUALITY CONTROL

A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

3.5 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting installed construction.

B. Do not install hydronic pressure gauges until after systems are pressure tested.

3.7 FLOW MEASURING SCHEDULE

A. LOCATION.

1. Heating water system (Each device and coil).
2. Domestic circulation pump.
3. Domestic circulation branch piping.

3.8 PRESSURE GAUGE SCHEDULE

A. LOCATION.

1. Boiler (Inlet and Outlet).
2. Pumps.

3.9 TEST PLUGS SCHEDULE

A. LOCATION.

1. Control valves 3/4 inch & larger - inlets and outlets.
2. Major coils - inlets and outlets.

3.10 STEM TYPE THERMOMETER SCHEDULE

A. LOCATION.

1. Headers to central equipment.
2. Boilers - inlets and outlets.

3.11 EXPANSION TANK SCHEDULE

A. SEE DRAWINGS.

END OF SECTION

SECTION 232123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. System lubricated boiler circulators.
2. Base mounted pumps.
3. Shaft grounding.

B. Related Sections:

1. Section 232113 - Hydronic Piping: Execution requirements for connection to pumps specified by this section.
2. Section 232116 - Hydronic Piping Specialties: Product and execution requirements for piping specialties installed in hydronic systems adjacent to pumps.
3. Section 235122 - High-Efficiency Boiler, Primary Pumps, Venting.
4. Section 260503 - Equipment Wiring Connections: Execution requirements for electrical connections to pumps specified by this section.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000-Volts Maximum).

B. Underwriters Laboratories Inc.:

1. UL 778 - Motor Operated Water Pumps.

1.3 PERFORMANCE REQUIREMENTS

A. Provide pumps to operate at system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes and finishes.

C. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Alignment: Base mounted pumps shall be aligned by a qualified millwright.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for pumps.

1.10 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of mechanical seals for each pump.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ITT - Bell & Gossett.

B. TACO.

C. Armstrong.

2.2 SYSTEM LUBRICATED BOILER CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected with ECM drive and wet rotor for in-line mounting, at 140 psig maximum working pressure, 230°F maximum water temperature.

B. Casing: Cast iron with flanged pump connections.

C. Impeller and Shaft: 420 Stainless Steel.

D. Bearings: Carbon Sleeve.

1. Motor: Impedance protected, variable speed by ECM or VFD.

E. All other wetted parts: 304 Stainless Steel.

F. Standard of design is B&G, Model Ecocirc XL.

2.3 BASE-MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radial or horizontal split casing, for 125 psig maximum working pressure.

B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Grease lubricated roller or ball bearings.

E. Seal: Silicone carbide rotating against stationary silicon seat, rated for 225° F maximum continuous operating temperature.

F. Drive: Flexible coupling with coupling guard.

G. Baseplate: Cast iron or fabricated steel with integral drain rim.

2.4 SHAFT GROUNDING

A. All pump motors controlled by a VFD shall have a shaft grounding kit installed. Refer to Specification Section 230513.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.

C. Install flexible connectors at or near pumps where piping configuration does not absorb vibration. Refer to Section 232116.

D. Provide line sized shut-off valve and strainer or pump suction fitting on pump suction, and line sized soft seat check valve, balancing valve, and shut-off valve on pump discharge or combination triple duty discharge valve on pump discharge. Refer to Section 232116.

E. As an option, the Contractor may utilize a Victaulic pre-constructed pipe drop to pump inlet and pump outlet. Victaulic Series 380 and Series 381.

F. Provide air cock and drain connection on horizontal pump casings.

G. Provide drains for bases and seals.

H. Check, align, and certify alignment of base mounted pumps prior to start-up.

I. Install base mounted pumps on concrete housekeeping pad, with anchor bolts set and level, and grout in place. Refer to manufacturer's installation instructions for grouting requirements.

J. Lubricate pumps before start-up.

K. Primary pump for each boiler shall be provided as part of the boiler package. Pump speed provided by ECM with signal from the boiler controls package. Refer to boiler specification, schedule and details.

3.2 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect for alignment of base mounted pumps.

3.3 SCHEDULES

A. See Schedule on Drawings.

END OF SECTION

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SECTION 232126 - GLYCOL SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

A. Storage tank or barrels.

B. Propylene glycol, 35% solution.

1.2 RELATED WORK

A. Section 232113 - Hydronic Piping.

B. Section 232150 - Chemical (Water) Treatment.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

B. Submit glycol test results at project completion.

C. Submit glycol test results at 11 month occupancy.

1.4 WARRANTY

A. Replace propylene glycol solution lost from the systems from any cause other than neglect by Owner during the first year of operation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Dow Chemical.

B. Freemont Industries.

C. Union Carbide.

D. Interstate Chemical.

E. Rhomar Water.

F. Jaytech Water Management.

2.2 GLYCOL SYSTEM (FACTORY PRE-MIXED)

A. Provide glycol solution for heating systems.

2.3 GLYCOL SOLUTION

A. Provide factory pre-mixed 35% Propylene glycol and water solution suitable to a freeze protection temperature of 0°F and a burst protection of -50°F. If greater concentration than 35% is required to provide the indicated temperature protection levels, the contractor shall provide it at no additional cost to the Owner.

B. The Mechanical Contractor shall utilize their piping take-off and equipment gallon capacities from suppliers to establish total system capacity.

C. Provide one extra 55-gallon drum of factory pre-mixed glycol solution.

D. The Mechanical Contractor shall fill the new system using only a factory pre-mixed solution and shall provide a hose fill connection unless noted otherwise on plan.

E. The water used in the pre-mixed solution shall be either distilled or de-ionized.

PART 3 EXECUTION

3.1 GLYCOL DEGRADATION OF EXISTING SOLUTION

A. Before connecting to or modifying the existing hot water system the Mechanical Contractor shall test the solution for glycol type, strength and chemical make-up strength and provide test results to the Owner and Engineer for their review. These results will determine what adjustments may be needed by the Owner to bring it to 35% Propylene glycol solution with appropriate inhibitors.

B. If new piping is going to be connected to an existing glycol system, glycol degradation testing must be conducted on the loop by the independent water treatment and glycol sub-contractor prior to new piping connection. Testing must include:

1. Glycolate, Acetate, Formate, Oxalate organic acids (under 300ppm combined organic acid required).
2. Tolyltriazole (more than 10ppm required).
3. Dissolved Copper (Less than 1 Mg/L required).
4. Dissolved Oxygen (Less than 1 Mg/L required).
5. Nitrite as NO2 (more than 1000ppm required).
6. Dissolved Iron (Less than 0.5 Mg/L required).
7. Molybdenum (No molybdenum allowed due to discharge concerns).
8. Suspended Solids via a Babcock/Wilcox filter patch study (100 ppb or less).

C. If any of the above tests do not fall within required limits, the existing glycol system must be treated and retested until test results fall within range. All costs for adjusting the existing solution before new piping connection shall be additional maintenance costs to the Owner and are not part of this contract.

3.2 INSTALLATION

A. Mechanical Contractor shall thoroughly clean and flush the new piping added to the existing system and the new piping system connected to the new boilers before adding factory pre-mixed glycol solution. Refer to Specification Section 23 2150 for testing requirements by an independent water treatment and glycol provider. Final flush shall be with softened water.

B. Mechanical Contractor shall provide necessary piping to complete installation.

C. Mechanical Contractor shall pump the factory pre-mixed solution into the piping system through a hose connection on the Mechanical Room system.

D. Perform chemical test to determine quality of glycol solution before the system is turned- over to Owner. Add pure glycol as required to pre-mixed solution to obtain final 35% Propylene solution. (Use attached analysis form for test.) Provide a second test at the eleventh (11th) month of operation. Replenish glycol and/or inhibitors as required.

E. As part of the Owner's O & M manuals, the Mechanical Contractor shall provide system capacity and quality test results on the solution as follows on attached sheet. System capacity shall be recorded during initial fill for the best possible quantity estimate.

F. When using factory pre-mixed glycol solutions, test final glycol concentration after circulating it for a minimum of two weeks and add pure glycol as required to raise concentration to the specified level. This may be required due to the inability to get all of the flushing water out of the system prior to putting in the factory pre-mixed glycol solution.

G. The Mechanical Contractor shall be responsible for correction of any system damage due to freezing of the hydronic fluid for the first winter after the glycol solution is installed in the system.

END OF SECTION

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SECTION 232150 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. System cleaner.
2. Closed system treatment (water).

1.2 PERFORMANCE REQUIREMENTS

A. Drain and capture entire system solution.

B. After total system flushing is complete, refill the system with the captured solution and add pre-mixed glycol solution to fill the system.

C. Closed System - After initial fill with pre-mixed solution any additional water added to the system shall be either softened or RO.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit chemical treatment materials and chemicals.

C. Manufacturer's Installation Instructions: Submit placement of equipment in systems, piping configuration, and connection requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of equipment and piping.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 150 miles of Project with water analysis laboratories and full time service personnel.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Maintenance service.

1. Hot Water/Glycol - Provide all testing and chemical adjustments at system turn-over to owner and then one to two weeks prior to the 1-year warranty end.

B. Furnish technical service visit, to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements and corrective actions needed. Submit two copies of field service report after each visit.

C. Furnish laboratory and technical assistance services during this maintenance period.

D. Furnish on site inspections of equipment during scheduled or emergency shutdown and after any leaking problems to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

PART 2 PRODUCTS

2.1 SYSTEM CLEANER

A. Manufacturers:

1. Jaytech - JT3450 or JT3415.
2. Fremont Corp. - 8815 System Cleaner.
3. Interstate Chemical.
4. Nalco.
5. D.L.C.S.
6. U.S. Water.
7. Substitutions: Division 01 - Product Requirements.

B. Product Description: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tri-Poly phosphate and sodium molybdate if allowed by local municipality.

2.2 CLOSED SYSTEM TREATMENT (WATER)

A. Manufacturers:

1. Fremont Corp.
2. Jaytech.
3. Interstate Chemical.
4. Nalco.
5. D.L.C.S.
6. U.S. Water.
7. Substitutions: Division 01 - Product Requirements.

B. Chemical treatment to be comprised of polymeric scale retardants, sodium nitrate, pH control additives, triazole copper inhibitors and phosphonates.

C. Sodium molybdate may be used if permitted by municipality.

PART 3 EXECUTION

3.1 PREPARATION

A. Operate, fill, start and vent new piping system and piping added to the existing systems prior to cleaning. Use water meter or trace chemical calculation method to record capacity in each system. Place terminal control valves in open position during cleaning.

B. Provide a permanent tag with “updated total” system capacity information and attach it to the pot feeder side stream filter. Also, record the system capacity information in the Owner’s manual.

3.2 TEMPORARY CIRCULATING PUMP FOR SYSTEM CLEANING

A. The scope of this project includes adding new hydronic piping loop connected to the existing larger building hydronic loop. The mechanical contractor shall temporarily isolate the new piping loop as required so that it may be cleaned independent of the larger building loop. A temporary pump shall be connected to the loop and utilized to meet the cleaning requirements of this section. The pump shall be removed after the cleaning process is complete. The new loop will then be connected to the existing larger building loop.

3.3 INITIAL TESTING

A. A. The water source for filling and flushing must be tested and approved by contracted chemical treatment company to verify compatibility with cleaners, glycols and inhibitor packages.

B. If new piping is tying into an existing system, the existing system must be tested to verify the system “starting point”. It will be the mechanical contractor’s responsibility to coordinate with the Owner’s Representative all adjustments and improvements needed with the existing piping system to bring it to a good, clean and chemically balanced condition. Costs for these adjustments shall be the Owner’s responsibility. When the existing system’s quality is established to the Owner and Engineers satisfaction the Mechanical Contractor shall ensure that the final system is of the same or better quality than the existing system “starting point”.

3.4 INITIAL SYSTEM FLUSH

A. The addition to the existing system and the new boiler/piping system will initially be filled with approved water and thoroughly flushed to remove any dirt and debris from the materials of construction. The system must be filled and drained from points which maximize flow throughout the entire loop. A system pressure of at least 10 psig must be maintained during the flush.

B. All valves in the loop must be in the open position during the flushing process.

C. The initial flush must last for at least four continuous hours. The flush will be considered a success when the water exiting the loop contains less than 80 ppb of total suspended solids.

3.5 SYSTEM CLEANING

A. The system will be filled to 5% of total volume with Jaytech's JT3450 or JT3415 (or equal) all in one multi-metal cleaning solution.

B. The system must be circulated with the cleaner continuously for at least 48 hours and no more than 10 days. Old or fouled piping may require additional cleaner or circulation time.

C. The addition to the existing system must be filled and drained with approved water from points which maximize flow throughout the entire loop. A system pressure of at least 10 psig must be maintained during the flush.

D. The addition to the existing system must then be flushed for a period lasting at least 48 hours but no more than 7 days.

E. The flush will be considered a success when the water exiting the loop contains less than 80 ppb of total suspended solids and less than 300 RLUs of biological content using an ATP test meter.

F. Sufficient flush water is imperative to the timeline of the flushing process. 15- 30 times the systems volume per day must be maintained.

G. As part of the process, all strainers in the system shall be cleaned. All strainers installed under this contract shall be checked by this Mechanical Contractor. The owner's maintenance staff are responsible for checking and cleaning all other strainers in the building. Mechanical Contractor shall coordinate strainer cleaning with the owner's staff.

3.6 CLOSED LOOP TESTING

A. Babcock/Wilcox Millepore testing and biological testing must be conducted on each loop that is cleaned and flushed at the cost of the mechanical contractor. Millepore results must yield less than 80 ppb of total suspended solids and ATP biological testing must yield less than 300 RLUs in order to consider the clean and flush a success.

B. The water treatment company testing both the new and additional piping and the existing the loop must provide a written report documenting all testing conducted on the loop. Copies of the report must be provided to the mechanical contractor, general contractor and the building owner.

3.7 CLOSED SYSTEM TREAMENT

A. Provide one side stream filter for the new system. Install isolating and drain valves and interconnecting piping. Install around pump differential to insure adequate flow.

B. Introduce closed system treatment through side stream filter bypass feeder when required or indicated by testing.

END OF SECTION

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SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct materials.
2. Insulated flexible ducts.
3. Single wall spiral round and flat oval ducts.
4. Double wall spiral insulated round and rectangular.
5. Transverse duct connection system.
6. Ductwork fabrication.
7. Cleaning of new duct surfaces by Mechanical Contractor.
8. Clothes dryer ductwork.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
3. Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
4. Section 230700 - Duct Insulation: Product requirements for duct lining and wrapping.
5. Section 233300 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction standard - Metal and Flexible.
2. SMACNA - HVAC Air Duct Leakage Test Manual.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data Shop Drawing: Submit data for duct materials, duct liner and duct connectors.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show any additional fittings that were used.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 DEFINITIONS

A. Rectangular Duct Sizes: Metal duct dimensions are indicated on plans and the sizes on the plans have been increased to take any duct liner into account (where the ducts are specified to be lined).

B. Low Pressure Classification: 2 inch WG positive or negative static pressure and velocities less than 2,500 fpm.

1.9 PAYMENTS

A. During the construction period ductwork shall not be considered billable on a payment request until it has been fabricated and delivered to the job site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 or G90 zinc coating of in conformance with ASTM A90.

1. G90 galvanized used on duct exposed to weather or high moisture areas such as showers, exhaust, kitchen exhaust, etc.

B. Insulated Flexible Ducts:

1. Manufacturers:

a. Anco-Flex.
b. Norflex.
c. Wiremold.
d. Thermaflex II.

2. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.

a. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
b. Maximum Velocity: 4000 fpm.
c. Temperature Range: -20°F to 175°F.

3. Multiple layers of aluminum laminate supported by helically wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.

a. Pressure Rating: 10 inches WG positive and 1.0 inches negative.
b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -20°F to 210°F.

C. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic tested in accordance with ASTM E-84-80 and to not exceed 25 flame spread and 50 smoke developed.

D. Joint Sealer: Acceptable Manufacturer - Minnesota Mining and Manufacturing Duct Sealer 900, Foster 30-02 Ductmate Industries 795 Duct Sealer or 5511M if applied at the time of forming.

E. Fasteners: Rivets, bolts, or sheet metal screws.

F. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Acoustical lining is required for a minimum of the first 15 feet (or more as shown on plans) of all supply and/or return air ductwork. In that length of lined ductwork provide air foil turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints. As an option, standard elbows may be used, but all seams must be sealed.

E. Provide standard rectangular to round efficiency takeoffs at branch duct takeoff. Conical spin-in branch take-offs are acceptable when main duct is tall enough to accommodate the throat of the branch duct plus two inches for the cone.

2.3 DOUBLE-WALL DUCT AND FITTING FABRICATION (ROUND, RECTANGULAR)

A. Manufacturers:

1. Lindab, Inc.
2. McGill AirFlow Corporation.
3. SEMCO, Inc.
4. Sheetmetal Connectors, Inc.
5. FabDuct.
6. Midwest Spiro Pipe.

7. Ducts and Cleats.

B. DUCTS: Fabricate double-wall (insulated) ducts for outdoor and indoor use with an outer shell and an inner duct. Dimensions indicated as __" I.D. are for the inner duct size. The outer shell dimension depends on thickness of insulation; 1" thick at inside systems and 3" thick at outside systems.

1. Outer Shell: G90 steel on exterior ducts and G60 steel on interior ducts. Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches longer than inner duct shell and insulation. Fabricate with metal thickness specified for single-wall duct.
2. Insulation : 3-inch thick at exterior ducts and 1" thick at interior ducts with, 3 lb/CF fibrous glass having R-4.1 / inch value. Terminate insulation where double-wall duct connects to single-wall duct or un-insulated components and reduce outer shell diameter to inner duct diameter.
3. Provide perforated inner wall (the first 25 feet from AHU supply and return connection) for sound attenuation. Fabricate with 0.028-inch-thick G60 sheet metal having 3/32inch-diameter perforations, with overall open area of 23 percent.
4. Solid inner wall: (after 25 feet from AHU supply and return connection) use G60 galvanized with water-tight, gasketed joints at interior ducts. Use the following sheet metal thicknesses and seam construction.

    a. Ducts 3 to 8 Inches in Diameter: 0.019 inch (28 gauge) with standard spiral-seam construction.
    b. Ducts 9 to 42 Inches in Diameter: 0.019 inch with single-rib spiral-seam construction.

5. Maintain concentricity of inner wall to outer shell by mechanical means. Prevent dislocation of insulation by mechanical means.

C. FITTINGS: Fabricate double-wall (insulated) fittings with an outer shell to match straight sections of duct and an inner wall as follows.

1. Solid Inner Wall: G90 on exterior ducts and G60 on interior ducts. Use the following sheet metal thicknesses.

    a. Ducts 3 to 34 Inches in Diameter: 0.028 inch (24 gauge).
    b. Ducts 35 to 58 Inches in Diameter: 0.034 inch (22 gauge).

2. Perforated Inner Wall: Fabricate with 0.028-inch thick G60 galvanized sheet metal having 3/32-inch-diameter perforations, with overall open area of 23 percent.
3. Refer to Plans for ducts designated with a size followed by I.D. (inside diameter) for double wall. The duct size shown is actual inside sheet metal dimension.
4. Exterior jacket shall have paint grip surface that does not require any additional oil removal preparation before paint is applied.

2.4 TRANSVERSE DUCT CONNECTION SYSTEM

A. Manufacturers:

1. Ductmate.

2. Nexus.
3. SMC (R-Angle).
4. Ward Industries.
5. Transverse Duct Connections (TDC).
6. Fab Duct.
7. Approved equal prior to bidding.

B. MACNA "F" rated class rigidly connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

C. All components including sealants and gaskets shall be provided to meet manufacturer's requirements. No substitutions shall be allowed.

2.5 ACCEPTABLE MANUFACTURERS - ABOVE GROUND OVAL AND ROUND SPIRAL DUCTS

A. Midwest Spiro Vinyl-Cote Pipe Co.

B. Foremost Mfg. Co.

C. Wesco, Inc.

D. SMC Sheet Metal Connectors, Inc.

E. Tangent, Inc.

F. Norlock.

G. United McGill.

H. Semco.

I. Fab Duct.

J. Approved equal manufacturer prior to bidding.

2.6 EXPOSED G.I. SPIRAL AND RECTANGULAR DUCT

A. Above ground duct material shall be galvanized steel spiral duct. All fittings shall be constructed of same material, with all welded seams.

B. All exposed spiral and rectangular duct that is exposed in finished spaces shall be painted and shall be provided with paint grip coatings, ready for painting without further treatment by the painting Sub-Contractor.

C. Typical locations considered as "finished spaces" are gymnasiums, commons, auditoriums, offices and media centers. Storage rooms and mechanical rooms are not considered as "finished spaces" unless noted or scheduled by the Architect.

2.7 SHOWER AREA EXHAUST DUCTWORK

A. Construct of aluminum two gauges heavier then required by SMACNA standards for galvanized duct of dimension shown on plan.

1. G-90 galvanized ductwork is also acceptable.

B. Seal all joints water-tight to prevent leakage from ductwork caused by moisture-laden air.

2.8 CLOTHES DRYER DUCTWORK

A. Dryer exhaust ducts for clothes dryers shall terminate on the outside of the building and shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination.

B. Exhaust ducts shall have a smooth interior finish and shall be constructed of metal a minimum of 0.016 inch thick.

C. Exhaust ducts shall be supported at 4-foot intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude into the side of the duct.

D. The maximum length of the exhaust duct for a domestic dryer shall be 35 feet from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced by five (5) feet per 90 degree elbow.

E. The maximum length of the exhaust duct for a commercial dryer shall be determined by the dryer manufacturer’s installation instructions. Where fittings are used the maximum length of the duct shall be reduced by three (5) feet per 90 degree elbow.

F. Length Identification: Where the exhaust duct is concealed within the building construction, the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 6 feet of the exhaust duct connection to the dryer.

G. Commercial Clothes Dryers. The installation of dryer exhaust ducts serving commercial clothes dryers shall comply with the appliance manufacturer’s installation instructions. Exhaust fan motors installed in exhaust systems shall be located outside of the airstream. In multiple installations, the fan shall operate continuously or be interlocked to operate when any individual unit is operating. Ducts shall have a minimum clearance of 6 inches to combustible materials. Clothes dryer transition ducts used to connect the appliance to the exhaust duct system shall be limited to single lengths not to exceed 8 feet in length and shall be listed and labeled for the application. Transition ducts shall not be concealed within construction.

H. For common exhaust systems located in multi-story structures, refer to State code for duct construction and chase detail requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administration Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabrication of transitions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Duct supports shall be at duct joints and shall be installed at maximum of 8 feet or 10 feet dependent on SMACNA duct construction choices,

C. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal sleeve with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

1. Use double nuts and lock washers on threaded rod supports.
2. Ductwork support from roof decking is not allowed unless specifically approved by the Structural Engineer.

E. Joint Sealing - All low pressure ductwork to be sealed in accordance with SMACNA.

1. Seal Class 'C': Seal transverse joints only 2" WG and less.
2. Seal Class 'B': Seal all transverse joints and longitudinal seams 3" WG and less.
3. Seal Class 'A': Not Used.
4. In addition to the above, any variable air volume system duct of 1" and less WG construction class that is downstream of the VAV boxes shall meet Seal Class 'C'.

F. All outside air intake ductwork to be sealed water-tight at inside and outside of all joints before insulation wrap and vapor barrier jacket are installed.

G. Slope bottom portion of outside air, relief air and exhaust air ductwork downward toward bottom of wall louver connection so any water or snow infiltration drains out thru bottom gutter of louver with drainable blades. Seal all joints water tight.

H. Seal duct heating and cooling coil casing joints as required to eliminate air leakage.

I. Cross Breaking - Cross break all sheet metal surfaces of rectangular ducts 18 inches through 60 inches. Beaded ductwork may be used in lieu of cross breaking. Cross breaking may be omitted on internally lined ducts and on ducts 24 inches and larger where rigid insulation is applied to the exterior of the ducts.

J. Connect terminal units to supply ducts directly or with four foot maximum length of flexible duct. Flexible duct may be used to make minor offsets, but may not be used to make 20° or larger changes in direction. Provide a gradual in-line duct transition from rectangular to round duct as shown on plans.

K. Connect diffusers, return air grilles or light troffer boots to low pressure ducts either directly or with 6 feet maximum length of flexible duct to the collar extension or elbow mounted on the diffuser. Hold in place with strap or clamp. Exhaust registers shall be directly connected without use of flex. Extend flexible duct to the base of the diffuser neck or register collar. Overlap flex duct at insulated rigid branch duct and seal vapor tight. Refer to Code requirements for direct ducting to all devices within a fire-rated area or downstream of a fire barrier penetration. The flexible duct should not have sharp bends and should be installed with a large arc to minimize turbulence and pressure drop at the diffuser or grille.

L. Connect flexible ducts to metal ducts with liquid adhesive plus tape or draw bands and/or sheet metal screws.

M. During construction provide temporary closures of metal ducts with taped polyethylene at openings to prevent construction dust from entering ductwork system.

N. All ductwork stored on site must be protected from construction dust and dirt with polyethylene sheeting prior to duct installation. If ductwork is not protected and gets contaminated, it shall be fully cleaned to the Engineer's satisfaction prior to installation.

O. All in-line duct transitions shall be gradual (20°) taper to minimize pressure loss and noise increase due to turbulent flow.

P. All rectangular branch duct take-offs shall be installed with a high efficiency fitting as shown on plan. If a round branch duct is shown directly connected to a rectangular duct, either a spin-in conical take-off or rectangular to round transition is acceptable. Round spin-in take-offs are not approved.

Q. Seal all insulation terminations at diffusers, registers, branch ducts and main duct connections with tape such that no insulation is left exposed to ambient air.

R. When ductwork penetrates a wall or floor in a finished space, provide a sheet metal escutcheon to cover the gap around the duct and provide a neat finished appearance.

S. When aluminum ductwork is specified, the Contractor shall use all aluminum duct material for the entire system. If dissimilar metals are used in the system, a flexible connection shall be used between the metals to eliminate any galvanic action.

T. Provide gaskets and caulk sealants required for installation of a water-tight, double wall, duct systems when exposed to the weather.

U. Use perforated inner liner on minimum of first 15 feet of double wall supply ducts, return ducts and duct fittings that are connected to fan-powered equipment supply outlets and return inlets.

3.3 CLEANING (NEW DUCTWORK SURFACES ONLY)

A. Mechanical Contractor shall clean work under provision of Division 01.

B. A separate duct cleaning contractor is not required.

C. External Duct Cleaning: When external surfaces of exposed ducts are to be painted, the Mechanical Contractor shall remove all stickers, labels and excess adhesive from metallic or non-metallic ducts prior to painting whether they were factory, shop or field applied.

D. If the internal duct surfaces have not been adequately protected by plastic enclosure caps. The Mechanical Contractor shall clean duct system by forcing air at high velocity through the duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning. Equipment fans shall not be used for this duct cleaning. (This work does not require a duct cleaning company.).

3.4 SCHEDULES

A. DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply/Return (Heating and/or A.C. Systems)	Steel
Shower Area Exhaust	Aluminum, G90 Steel
General Exhaust	Steel
Outside Air Intake	Steel
Combustion Air	Steel
Gravity or Powered Relief	Steel
Clothes Dryer	Aluminum

B. DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Variable Volume (Downstream of Boxes)	1 inch regardless of velocity
Variable Volume (Upstream of Boxes)	2 inch regardless of velocity
Constant Volume Supply (System w/Cooling Coils)	2 inch
Return and Relief	1 inch
General Exhaust	1/2 inch
Outside Air Intake	1 inch
Combustion Air	1/2 inch
Clothes Dryers	1 inch

3.5 MINIMUM DUCT SEAL LEVELS

	SUPPLY DUCT STATIC			
DUCT LOCATION	≤ 2” W.C.	>2”W.C.	EXHAUST	RETURN
CONDITIONED SPACE	B	B	B	C

DUCT SEAL LEVELSTYPE - A: NOT USED.TYPE - B: ALL TRANSVERSE JOINTS AND LONGITUDINAL SEAMS. PRESSURE-SENSITIVE TAPE SHALL NOT BE USED AS THE PRIMARY SEALANT, UNLESS IT HAS BEEN CERTIFIED TO COMPLY WITH 181A OR UL-181B BY AN INDEPENDENT TESTING LABORATORY AND THE TAPE IS USED IN ACCORDANCE WITH THAT CERTIFICATION.TYPE - C: TRANSVERSE JOINTS ONLY.

3.6 DUCT CONSTRUCTION TABLE

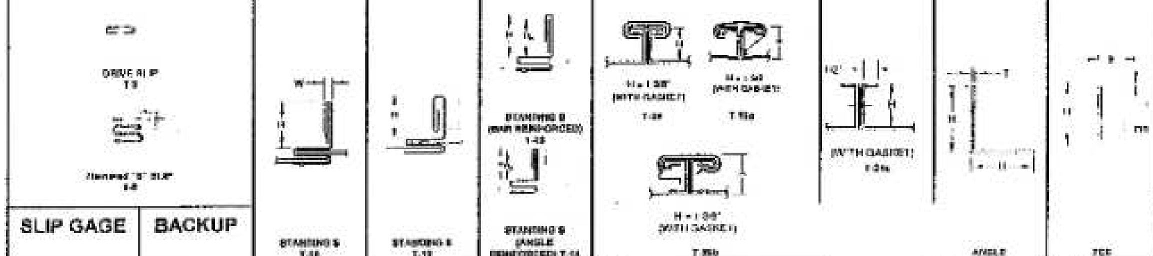
A. The following table does not constitute all requirements for the construction's compliance. Complete details are provided in the manual entitled HVAC Duct Construction Standards, Metal and Flexible.

1. Use back-up member from Columns 11 or 12. Exception: The drive only requires back-up over 20" length.
2. Spacing in Column 3 refers to joint-to-joint, joint-to-intermediate or intermediate-to-intermediate.
3. The same sheet thickness must be used on all sides of duct. Each duct dimension, width or depth, controls the minimum reinforcement requirements for that particular side.
4. Duct sides 19" wide and larger which have more than ten square feet of unbraced panel shall be beaded or cross broken unless the ducts will have external insulation or internal liner. This applies to ducts of 20 gauge or less.
5. Duct with 4 feet joint spacing shall conform as if 4' and 2' were given in Column 3 where 5' and 2-1/2' are shown.

B. Table 1-4 E5, & 1-5 E5

NARROWSCOPE DUCT CONSTRUCTION TABLE 1-4 E5

1" w.g. STATIC POS. OR NEG. (SMACNA)



(1) DUCT DIM.	(2) DUCT GA. (MIN.)	(3) REINF. SPACING (MAX.)	(4) REINF. CODE GRADE	(5) SLIP GAGE	(5) BACKUP	(6) STANDING S T-10	(7) STANDING S T-12	(8) STANDING S (ANGLE REINFORCED) T-14	(9) T-25b	(10)	(11) ANGLE	(12) TEE
12" dn	26	None		24	Note	H x T	H x T	H x T + HR	H = 1 3/8"	H x T	H x 1 (MIN)	H x B x 1 (MIN)
13"-30"	26	8'	B	24	*	↓	↓	NOT USED	26 ga	1 x 22 ga	↓	1 x 3/4 x 18 ga
31"-36"	24	8'	D	24	*	1 1/8 x 20 ga	1 1/2 x 22 ga					
37"-42"	24	5'	E	24	*	1 1/8 x 18 ga	1 x 18 ga		24 ga	1 1/2 x 20 ga	1 1/4 x 12 ga or 1 x 1/8	1 1/2 x 3/4 x 16 ga
43"-54"	22	5'	F	24	*	1 5/8 x 18 ga	1 1/2 x 18 ga		22 ga		1 1/2 x 1/8	
55"-60"	24	2 1/2'	E	24	*	1 1/2 x 18 ga	1 x 18 ga		24 ga		1 x 1/8	
61"-72"	24	2 1/2'	F	24	*	1 5/8 x 18 ga	1 1/2 x 18 ga		22 ga		↓	
73"-84"	22	2 1/2'	H	22	*	NOT GIVEN	NOT GIVEN	1 5/8 x 18 ga 1 1/2 x 1/8 Bar	20 ga + rods	NOT GIVEN	1 1/2 x 1/4	
85"-96"	20	2 1/2'	H	22	*	↓	↓					1 1/2 x 3/4 x 1/8

NOTES:

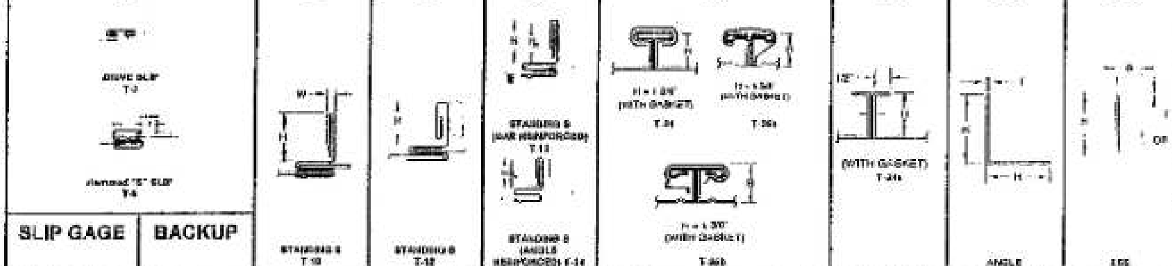
1. *Means use back-up member from columns 11 or 12. Exception: the drive only requires back-up over 20" length.
2. Spacing in column 3 refers to joint-to-joint, joint-to-intermediate, or intermediate to intermediate.
3. The same sheet thickness must be used on all sides of duct. Each duct dimension, width, or depth, controls the minimum reinforcement requirements for that particular side.
4. Duct sides 19" wide and larger which have more than ten square feet of unbraced panel shall be beaded or crossbroken unless the ducts will have external insulation or internal liner. This applies to ducts of 20 ga. or less.
5. Contents of the narrow scope tables and these notes do not constitute all requirements for the construction's compliance. Complete details are provided in the manual entitled HVAC Duct Construction Standards, Metal and Flexible. The manual is available from local SMACNA chapter offices or the National Association office; Inquire for terms.
6. Construction conforming to the standard does not prevent some traditionally acceptable runouts (noises) under sudden pressure change conditions such as start up and shut down of systems.

COMMENT:
Construction tables are prepared in "narrow scope" for 2" water gage and 1" water gage pressure classifications. These tables have been produced for the convenience of those contractors or engineers who wish to have fewer options.

Sheet Metal and Air Conditioning
Contractors Association, Chantilly, Va

NARROWSCOPE DUCT CONSTRUCTION TABLE 1-5 E5

2" w.g. STATIC POS. OR NEG. — SMACNA



① DUCT DIM.	② DUCT GA. (MIN.)	③ REINF. SPACING (MAX.)	④ REINF. CODE GRADE	⑤ SLIP GAGE	⑤ BACKUP	⑥ TRANSVERSE JOINT REINFORCEMENT: STANDING S T-10	⑦ STANDING S T-12	⑧ STANDING S (ANGLE REINFORCED) T-14	⑨ T-24 / T-24a / T-25b	⑩ T-24a	⑪ INTERMEDIATE REINFORCEMENT: ANGLE	⑫ ZEE
10" dn	26	None		26	None	H x T	H x T	H x T + HR	H = 1 3/8"	H + T	H x T (Min)	H x B x T (Min)
11"-20"	26	5'	C	26	*	1 x 22 ga	1 x 22 ga	NOT USED	26 ga.	1 x 22 ga	1 x 1/8	1 x 3/4 x 18 ga
21"-26"	26	5'	D	24	*	1 1/8 x 20 ga	1 x 20 ga				1 1/4 x 12 ga or 1 x 1/4	
27"-30"	24	5'	E	24	*	1 1/8 x 18 ga	1 x 18 ga		24 ga.	1 1/2 x 20 ga		1 1/2 x 3/4 x 16 ga
31"-36"	22	5'	F	24	*	1 3/8 x 18 ga	1 1/2 x 18 ga	1 5/8 x 22 ga 1 1/2 x 1/8 Bar	20 ga		2 x 1/8	
37"-54"	24	2 1/2'	F	24	*	1 5/8 x 18 ga	1 1/2 x 16 ga	1 5/8 x 20 ga 1 1/2 x 1/8 Bar				
55"-60"	24	2 1/2'	G	24	*	NOT GIVEN	1 1/2 x 16 ga	1 5/8 x 22 ga 1 1/2 x 1/8 Bar	22 ga + rods	1 1/2 x 18 ga		
61"-72"	22	2 1/2'	H	24	*	NOT GIVEN	NOT GIVEN	1 5/8 x 18 ga 1 1/2 x 1/8 Angle	18 ga + rods	NOT GIVEN		2 1/2 x ... x 1/8
73"-84"	20	2 1/2'	I	22	*			2 1/8 x 20 ga 2 x 1/8 Angle			2 x 3/16	3 x 1 1/4 x 12 ga
85"-96"	20	2 1/2'	I	22	*							

NOTES:

1. "Must use back-up member from columns 11 or 12. Exception: the drive only requires back-up over 20" length
2. Spacing in column 3 refers to joint-to-joint, joint to intermediate, or intermediate-to-intermediate.
3. The same sheet thickness must be used on all sides of duct. Each duct dimension, width, or depth, controls the minimum reinforcement requirements for that particular side.
4. Duct sides 19" wide and larger which have more than ten square feet of unbraced panel shall be beaded or crossbroken unless the ducts will have external insulation or internal liner. This applies to ducts of 20 ga. or less.
5. Contents of the narrow scope tables and these notes do not constitute all requirements for the construction's compliance. Complete details are provided in the manual entitled HVAC Duct Construction Standards, Metal and Flexible. The manual is available from local SMACNA chapter offices or the National Association office; inquire for terms.
6. Construction conforming to the standard does not prevent some traditionally acceptable rumble (noise) under sudden pressure change conditions such as start up and shut down of systems.

COMMENT:
Construction tables are prepared in "narrow scope" for 2" water gage and 1" water gage pressure classifications. These tables have been produced for the convenience of those contractors or engineers who wish to have fewer options.

Sheet Metal and Air Conditioning Contractors Association, Chantilly, Va.

ABOVE GROUND LONGITUDINAL SEAM ROUND DUCT	
GAUGE	SIZE
22	15" TO 26"
24	9" TO 14"
26	3" TO 8"

SPIRAL SEAM @ EXPOSED ROUND AND FLAT OVAL DUCT		
GAUGE	DUCT DIAMETER	FITTING DIAMETER
20	52" AND UP	38" TO 60"
22	38" TO 50"	30" TO 36"
24	28" TO 36"	20" TO 28"
24	16" TO 26"	14" TO 18"
26	4" TO 14"	4" TO 12"

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Back-draft dampers.
2. Duct access doors.
3. Dynamic fire dampers.
4. Smoke dampers.
5. Volume control dampers.
6. Flexible duct connections.
7. Duct test holes.
8. Paint booths.
9. Welding exhaust accessories.
10. Kiln hood exhaust.

B. Related Sections:

1. Section 230923 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke/Fire Dampers for placement by this section.
2. Section 233100 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
3. Section 260503 - Equipment Wiring Connections: Execution requirements for connection of electrically actuated smoke dampers specified within this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

D. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:

1. UL 555 - Standard for Safety for Fire Dampers.
2. UL 555S - Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.

1. Fire dampers including locations and ratings.
2. Smoke dampers including locations and ratings.
3. Backdraft dampers.
4. Flexible duct connections.
5. Volume control dampers.
6. Duct access doors.
7. Duct test holes.

E. Product Data: For fire dampers and smoke dampers, submit the following:

1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
2. Indicate materials, construction, dimensions and installation details.
3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

F. Manufacturer's Installation Instructions: Submit for Fire and Smoke Dampers.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access doors, test holes.

C. Operation and Maintenance Data: Submit for Combination Smoke/Fire Dampers.

1.5 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work where appropriate with building control Work.

1.9 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each size and type of fusible link.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - VOLUME CONTROL PRODUCTS

A. Greenheck.

B. Dowco.

C. Cesco.

D. Nailor.

E. Ruskin.

F. Air Balance.

G. Pottorff.

H. Duro Dyne.

2.2 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4 inch diameter rod in self aligning, universal joint action flanged bushing with set screw.

C. Fabricate single blade dampers for duct sizes through 9-1/2 x 30 inches.

D. Fabricate multi-blade damper of opposed blade pattern with maximum blade from sizes 12 x 30 inch and larger. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

F. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

G. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.3 ACCEPTABLE MANUFACTURERS - CONCEALED DAMPER REGULATORS

A. Young Regulator.

B. Roto-Twist.

C. United Enertech.

D. Duro-Dyne.

2.4 CONCEALED DAMPER REGULATORS

A. In all inaccessible areas, i.e. plaster ceilings, use gear operated concealed damper regulators, set with hex nuts, similar to Duro Dyne Item #8008 Model SRC-380 (3/8" rod), with cast alloy corrosion resistive plated cover.

B. At duct provide a 90° angle drive die cast miter-gear assembly similar to Duro Dyne Item #8135/Model #AD-38 (3/8" rod).

C. If the concealed regulator cannot be mounted directly below the damper or if the 3/8" rod length exceeds 36" in length, a flexible cable drive may be utilized between the regulator and the damper.

2.5 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND SMOKE DAMPERS

A. Greenheck Fan Corp.

B. Air Balance.

C. National Controlled Air.

D. Cesco.

E. Ruskin.

F. Nailor.

G. Arrow Industries.

H. Pottorff.

2.6 DYNAMIC FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555.

B. Fire Resistance: 1-1/2 hours.

C. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

D. Construction:

1. Integral Sleeve Frame: Minimum code required gauge of roll-formed galvanized steel. Length: Six (6) inches on either side of wall.
2. Blades:

    a. Style: Curtain type.
    b. Action: Spring or gravity closure upon fusible link release.
    c. Material: Minimum 24 gauge roll formed, galvanized steel.

3. Closure Springs: Type 301 stainless steel, constant force type, if required.

E. Fusible Link Release Temperature: 165°F,

F. Mounting: Vertical or horizontal as indicated on Drawings.

G. Duct Transition Connection, Damper Style:

1. A style - rectangular connection, frame and blades in air stream.
2. LR style - round connection, blades out of air stream, non-sealed.

H. Finish: Mill galvanized.

2.7 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, 92A, 92B and UL 555S.

B. Leakage Rating: Class II, maximum of 20 cfm at 4 inches wg differential pressure.

C. Damper Temperature Rating: 250°F.

D. Frame: 16 gauge, galvanized steel.

E. Blades:

1. Style: Single skin with 3 longitudinal grooves or Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 16 gauge equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

F. Bearings: Stainless steel pressed into frame.

G. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

H. Linkage: Concealed in frame.

I. Actuator:

1. Type: Electric 120-volt, 60 hertz, two-position, fail close.
2. Mounting: External or it may be internally mounted in the air stream behind a 14x14 or larger grille/register face.

J. Sleeve: Factory installed 20 gauge sleeve, minimum 12 inches long.

K. Finish: Mill galvanized.

2.8 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A. Greenheck, Inc.

B. Louvers and Dampers.

C. Cesco, Inc.

D. Ruskin.

E. Arrow United.

F. American Warming Co.

G. Air Balance.

H. Nailor.

I. Pottoroff.

2.9 BACKDRAFT DAMPERS

A. Gravity backdraft dampers, size 18x18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.

B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of 18 gauge galvanized steel or aluminum with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together steel ball bearings and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure similar to Model No. ABD-200 (Aluminum) or HDD-150 (Steel) manufactured by Louvers and Dampers.

2.10 ACCEPTABLE MANUFACTURERS - AIR TURNING DEVICES

A. J & J Register Co.

B. Cesco, Inc.

C. Hart & Cooley.

D. Duro-Dyne.

2.11 AIR TURNING DEVICES

A. Units shall be similar to Duro-Dyne Vane Rail 24 ga. galv. iron.

2.12 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

A. Ventfabrics.

B. Ventglas.

C. Duro-Dyne.

2.13 INSULATED FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz per sq yd, approximately 6 inches wide, crimped into metal edging strip. Insulate with one inch thick flexible fiberglass insulation and a flame safe jacket. Similar to Duro-Dyne's insulflex connections.

2.14 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

A. Cesco.

B. Ruskin.

C. Advanced Air.

D. Nailor.

E. Kees.

F. Pottorff.

2.15 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards and as indicated.

B. Review locations prior to fabrication.

C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F. Access doors with sheet metal screw fasteners are not acceptable.

G. Provide all necessary regular and/or fire rated access doors in ceilings and walls for adjusting and/or fire damper re-setting. Refer to Division 01.

2.16 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installations are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Access Doors: Install access doors at the following locations and as indicated on Drawings:

1. Upstream of each VAV and duct-mounted reheat coil.
2. Before or after each automatic control damper.
3. Before and after each fire damper and smoke damper.

C. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access and as indicated on Drawings. Review locations prior to fabrication.

D. Provide balancing dampers at points on low pressure supply return and exhaust systems where branches are taken from larger ducts add additional dampers as required during air balancing. Use splitter dampers only where indicated.

E. Provide fire dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Provide backdraft dampers in relief ducts, for exhaust fans or exhaust ducts nearest to outside wall/roof or where indicated.

G. Install smoke dampers in accordance with NFPA 92A.

H. Demonstrate re-setting of fire dampers to Owner's representative.

I. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.

J. Use splitter dampers only where indicated.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille or register assembly.

M. Provide duct test holes where indicated and required for testing and balancing purposes. Also provide plugs for holes.

N. Mechanical Contractor shall provide all necessary surface access doors on finished walls and non-accessible ceilings to adjust and/or reset the mechanical systems in finished spaces. Use

fire-rated doors on fire-rated surfaces. Dampers may be controlled by concealed damper operators in lieu of access doors if feasible.

O. Install concealed regulators to operate manual volume dampers located above permanent, inaccessible ceiling. Utilize components of one manufacturer only and install per manufacturer’s instructions.

P. Coordinate destratification fan installation with Division 26 Contractor to insure that hard wiring or plug wiring for the fan follows structural elements to terminal box in order to avoid or minimize any visible hanging wiring or loop.

3.3 FINISH ROOM FILTER WALL AND EXHAUST DUCTWORK

A. Install the filter wall as per manufacturer's directions. Include all necessary labor and miscellaneous materials for a complete system of exhaust.

B. Provide for blanking-off of wall area on all sides of the filter rack in order to insure integrity of the plenum behind the filters and all air needing to pass through the filter material.

3.4 AIR TURNING DEVICES

A. Provide air turning rails in all large supply and return air ductwork with 90° turns. (Use in 18" and larger ductwork.).

B. Use hollow type units in ducts over 39" in width.

3.5 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 233315 - DUCT CLEANING AND EQUIPMENT CLEANING

PART 1 GENERAL

1.1 SUMMARY

A. Description of Work.

1. Work to be performed under this section consists of supplying all equipment, accessories, material and labor to complete the system cleaning by source removal methods of dirt, bacteria, fungi, dust and debris that have accumulated inside the ducts and HVAC equipment.
2. This work applies to the existing air handling unit, supply ducts, return ducts and outside air intake ductwork, as noted on the plan sheets.

B. Related Sections.

1. 233100 - HVAC Ducts.
2. 233300 - Air Duct Accessories.
3. 234000 - HVAC Air Cleaning.

1.2 QUALITY ASSURANCE

A. Qualifications: The cleaning of HVAC systems/ductwork shall be performed by a Ventilation Cleaning Contractor which has on staff management/operations personnel who are certified by National Air Duct Cleaners Association (NADCA).

1.3 CONTINUITY OF SERVICE

A. Contractor shall not interrupt existing services except at such times and for such periods of time as is acceptable to the owner.

1.4 CODES AND PERMITS

A. This Contractor shall obtain and pay for all permits or licenses required under this contract.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Submittal Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.

1. List of equipment and methods to be used.
2. List of similar projects where the same equipment and methods were used for reference.

1.6 SUMMARY OF WORK

A. Air ducts shall be cleaned to meet NADCA (National Air Duct Cleaners Association) Standard ACR-2005.

B. Remove and dispose of all visible dirt, debris and other contaminates.

C. Clean and decontaminate all existing supply, return and outside air ductwork, diffusers, grilles and registers as noted on plans. New ductwork and equipment need not be cleaned.

D. Chemical pressure wash and decontaminate all existing heating and cooling coils as noted on plans.

E. Clean and decontaminate dampers, supply air fans, and other components of the existing systems as noted on plans.

F. Repair of damaged fiberglass duct liner and coating of all existing internal duct insulation (fiberglass duct liner) and repaired liner areas with insulation coating shall be addressed. If damaged areas are not noted on plans, the cleaning contractor shall provide a list of needed duct and insulation repairs that are observed during cleaning. A repair cost for each item listed shall be provided to the owner/architect/engineer for their review, acceptance or rejection.

G. Replace damaged mechanical insulation in air-handling units with IMCOA where deemed necessary. Provide a list of "other areas" needing repairs compiled with an additional cost for each repair listed for owner's review and rejection or approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Access Panels:

1. Pre-manufactured sheet metal service panels that are cross broke, hemmed, pre-drilled and gasketed.
2. Pre-manufactured service panels (same as above) but with liner.
3. Pre-manufactured access door with locking seal.

B. Sealants: Use a silicone based product specifically rated for sealing ductwork.

1. Air tight plugs.

C. Cleaning Chemicals: Chemicals for cleaning coils, dampers and fans.

1. Degreaser - Zep.
2. Coil Cleaner - ReNeuz.
3. Sanitizer - Oxine (for non-porous surfaces only).

D. Insulation: “Tough Coat” mechanical insulation repair coating designed specifically for mechanical insulation. This repair coating shall not affect thermal or acoustical properties of the insulation, must meet NFPA Standard 90A and 90B, must meet State of Minnesota TVOC

requirements, must have anti-microbial agent that meets the Microbiological Testing Standards of UL181, ASTM C1071, ASTM G21, ASTM G22.

1. IMCOA: An expanded, closed cell, polyolefin type liner used to replace damaged mechanical insulation in air-handling units, rooftop units and other areas.

2.2 EQUIPMENT

A. Cleaning Collection System: For HVAC cleaning and decontamination use a vacuum collection system or approved equal. The unit shall incorporate a HEPA filtered vacuum collector system which shall be capable of maintaining up to 1 inch of static pressure inside the isolated area of ductwork as stated in ACR2005. All operations shall be subject to the approval of Owner's on-site representative.

1. HEPA filtration on all indoor wet/dry vacuums.
2. Electrical air compressor capable of providing a minimum of 160 psi at 26 CFM.
3. Duct cleaning system consisting of the following equipment:

    a. Portable power brushing for duct agitation.
    b. Portable pressure washer with operating ranges from 500 PSI at.7 GPM to 1200 PSI at 1.7 GPM.

PART 3 EXECUTION

3.1 WORK AREA PREPARATION

A. Preparation: Protect all furnishings, equipment, etc. in work area with polyethylene or equivalent.

1. Provide video or still pictures in hard copy and on a "CD" format of before and after the cleaning process for quality assurance and documentation.
2. Seal off ends and openings of any ductwork, not being immediately worked on.
3. Suitably support and brace any ductwork which will be entered by personnel for decontamination, if deemed necessary by Cleaning Contractor.
4. Notify the owner/engineer of any unusual situations or areas needing cleaning that appear to be out of the scope of work before proceeding.

3.2 CLEANING AND DECONTAMINATING DUCTS

A. Small Ductwork: Small ducts are those which are not accessible to personnel to enter for cleaning purposes.

1. The vacuum collection cleaning method shall be used in these areas as specified.

B. Vacuum Collection Cleaning Method:

1. Provide within the ductwork protective seals of any areas downstream from receiving particulate during the installation of access points.

2. Existing exterior duct insulation and ductwork shall be neatly cut, as required, in order to provide access to facilitate cleaning of the ductwork and components. No access opening shall be larger than 22"x22". Reference NADCA 05 Standard.
3. Locate the vacuum collection unit at predetermined locations and clean the sections of the ductwork with the multi-directional nozzle and the pneumatically powered rotary brush system as deemed necessary. Large ducts which can be crawled into can be hand vacuumed or power brushed and air washed as deemed necessary. Pre-vacuum diffusers, grilles and registers in affected ductwork. If necessary, remove, chemically wash/clean and re-set. Isolate equipment which generates noise from occupied areas.
4. At the completion of each installation of the vacuum collection unit, notify the Engineer's or owner's on-site representative for a visual inspection of the cleaned ductwork. Photographic inspection recording shall be provided by Cleaning Contractor. Re-clean, if necessary, after photo review.
5. Where required (or needed) coat and repair mechanical insulation by applying Tough-Coat mechanical insulation repair coating following the procedures as outlined by the manufacturer or methods approved by the Engineer. At the completion of the application, notify the Engineer's or owner's on-site representative for final visual inspection.
6. Where noted on plans, remove mechanical insulation in air-handling unit, and other areas, and install IMCOA, a closed cell (waterproof) liner following the procedures as outlined by the manufacturer or methods approved by the Engineer. At the completion of the installation, notify the Engineer's or owner's on-site representative for final visual inspection.
7. Upon approval of Engineer's on-site representative, neatly patch ductwork in such a manner as to prevent any air leakage. When internal insulation has been cut for access, coat all exposed edges with Tough-Coat duct butter. Seal access openings with galvanized sheet metal of the same gauge as existing ductwork. Overlap the opening, zip-screw into place and provide silicone sealant or gasketing at the seams. Where indicated by Engineer, install pre-manufactured access doors. Cap all 1-inch holes with air-tight plugs.

3.3 LINER COATING

A. After cleaning and liner insulation repair, coat all existing and new fiberglass liner insulation with Tough-Coat or Fosters 40-20 product. Follow NADCA 05 Standards.

3.4 CLEANING FAN, DAMPER AND COIL UNITS

A. Cleaning Process: Chemically clean and power wash all coils, dampers and fan units employing the cleaning procedure outlined above.

1. Prepare work area, adjacent equipment and surfaces with polyethylene sheeting or equivalent.
2. Poly and tape all electrical surfaces and fan bearings.
3. Do not allow porous materials to get wet.

B. Vacuum Cleaning: HEPA vacuum all surfaces.

1. On surfaces with internal insulation, HEPA vacuum surface and (if necessary) repair/coat with Tough-Coat mechanical insulation repair coating.
2. Cleaning Metal Surfaces: On metal surfaces apply cleaning solution to surface, hand scrub, and rinse with pressure washer.

3. Start with ceiling, coils, condensate pans, fan inside, fan outside, walls (top to bottom) and floor.

C. Water Removal: Collect all water with HEPA vacuums.

1. Once the cleaned surfaces have dried, a visual inspection by the Engineer's or Owner's on-site representative shall be performed.

3.5 PROCESS FOR CLEANING IN-LINE COILS

A. Fluid Collection: Attach a water collection pan beneath coil and duct.

B. Access: Access openings shall be made upstream and downstream from the coils by the Cleaning Contractor.

1. Seal off duct upstream and downstream from coils as deemed necessary by Cleaning Contractor to contain cleaning solution and water.

C. Cleaner: An approved coil cleaner is applied to all coil facings using a low pressure sprayer. Material Safety Data Sheet will be furnished.

D. Pressure Wash: Pressure wash coils as needed to insure thorough rinsing. Maximum pressure used is 500 psi.

1. HEPA vacuum and wet wipe water from all areas of the coils and ductwork.
2. Once the cleaned surfaces have dried, a visual inspection by the Engineer's or owner's on-site representative shall be performed.

E. Access Opening Repair: If internal insulation was cut for access, coat exposed edges with Tough-Coat mechanical insulation repair coating or duct butter. Cover access openings with sheet metal patches, zip-screwed and silicone sealed or gasketed. Refer to NADCA 05.

3.6 PROCESS FOR INSTALLING IMCOA OR ARMAFLEX GRAY (A REPLACEMENT LINER FOR INSULATION REMOVED FROM AHU'S, ROOFTOP'S, JOBS WHERE FIBERGLASS LINER IS PROHIBITED, ETC.)

A. General: Make sure surface is clean and dry.

B. Pre-Cut: Pre-cut and ensure the cut is accurate.

C. Application: Apply adhesive to AHU Panels or duct surfaces and one side of IMCOA patch panel. Spray on surfaces with north/south and east/west grid pattern.

1. Set IMCOA in place immediately before adhesive dries.

D. Fasteners: Measure and mark location for 3-inch fasteners.

1. Pre-drill holes for pop rivets from the inside, ensuring no electrical, pneumatic or other lines on the outside of the Unit are drilled.

2. Using a rivet gun (pneumatic for best results) install pop rivet from the inside, or outside if panel is visible.
3. Install 3-inch fasteners to rivets - 1-ince from edges and 18" on center.

E. Seals: seal all butt joints and outside edges with proper sealant approved by insulation manufacturer.

3.7 SYSTEM FINAL PURGE

A. Work Area Preparation.

1. Cover all registers, grilles, diffusers, with cheesecloth or disposable blanket filter material. Seal airtight to device frame by use of tape.
2. Inform owner's representative that all air outlets have been covered and purging can proceed.

B. Insure all duct seals have been removed, all access openings covered and new filters have been installed.

C. Start air moving unit (HVAC) and purge continuously for a minimum of 30 minutes. If unit should be a variable speed unit, owner's representative shall designate a competent individual to run unit up and down (minimum to maximum speed) several times to insure minor debris is excavated from system.

D. Clean Up:

1. Remove cheesecloth or dirt entrapment material from outlets. Discard in an approved manner.
2. Should air terminal outlets be contaminated by this process, remove, wash and clean and reinstall as deemed necessary by cleaning Contractor.
3. Vacuum all work areas and restore to original condition.

E. Project Completion:

1. Complete a mandatory pre-cleaning and post-cleaning walk-through of all areas with owner's representative for final approval.
2. Complete any additional services/repair work approved by owner after review of "needed repair list".
3. Assemble all documentation needed for post project report, including still photographic and hard copies, along with a "CD" format of the pictures and submit to Engineer/Owner for final acceptance of completed work.

3.8 PLAN NOTES

A. Refer to Plan Sheets for specific locations and lists for.

1. Duct cleaning.

2. Coil cleaning.
3. AHU and RTU cleaning.

END OF SECTION

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SECTION 233327 - SOUND ATTENUATORS AND DUCT LAGGING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct Silencers.
2. Ductwork Lagging.
3. Roof Penetrations.

B. Related Sections.

1. Section 233100 - Joint Sealers.
2. Section 233100 - Ductwork: Connections to silencers.
3. Section 233300 - Ductwork Accessories: Flexible duct connections.

1.2 REFERENCES

A. AMCA 300 - Test Code for Sound Rating.

B. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. AMCA 302 - Application of Sound Loudness Ratings for Non-Ducted Air Moving Devices.

D. AMCA 303 - Application of Sound Power Level Ratings for Ducted Air Moving Devices Recommended Typical dBa Calculation.

E. ANSI S1.1 - Acoustical Terminology (Including Mechanical Shock and Vibration).

F. ANSI S1.13 - Methods for Measurement of Sound Pressure Levels.

G. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

H. ARI 575 - Measuring Machinery Sound within Equipment Rooms.

I. ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.

J. ANSI S1.8 - Preferred Reference Quantities for Acoustical Levels.

K. ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.

L. ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.

M. ASHRAE 68 - Method of Testing In-Duct Sound Power Measurement Procedure for Fans.

N. ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".

O. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

P. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission of Building Partitions.

Q. ASTM E477 - Method of Testing Duct Liner Materials and Prefabricated Silencers for Acoustical and Airflow Performance.

R. ASTM E596 - Method for Laboratory Measurement of the Noise Reduction of Sound Isolating Enclosures.

S. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

T. NEBB - Procedural Standards for Total System Balance.

U. AABC - National Standards for Total System Balance.

1.3 DEFINITIONS

A. Submittals, and Report: Conform to ANSI S1.1.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout and connection details.

C. Product Data: Provide catalog information indicating, materials, dimensional data, pressure losses and acoustical performance.

D. Design Data: Provide engineering calculations, referenced to specifications and Fan AMCA 301, Non-Ducted Equipment AMCA 302, Ducted Equipment AMCA 303 and Outdoor Equipment ARI 270 ASA 49 (ANSI S12.1) standards indicating that maximum room sound levels are not exceeded.

E. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers, acoustic housings meet or exceed specified sound transmission loss values.

F. Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 96 standards.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Price Sound Control.

B. I.A.C. - Industrial Acoustics Company.

C. Ruskin Sound Control/Rink.

D. Semco.

E. Vibro-Acoustics.

F. "VAW" Systems.

2.2 DUCT SILENCERS

A. Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Configuration: Rectangular with lined splitters with radiused nose and contoured tails.

C. Materials:

1. Outer Casing: Minimum 22 gauge thick galvanized steel stiffened as required, with mastic filled lock formed seams.
2. Inner Casing and Splitters: Minimum 24 gauge thick perforated galvanized steel.
3. Fill: Glass fiber or mineral wool of minimum 4 lb/cu ft density.

D. Rating:

1. ASTM E477 Insertion Loss and Maximum Generated Noise at 1000 FPM face velocity.
2. Air Tight Static Pressure: 10-inches wg.
3. Attenuators used in return or exhaust air applications must have certified data obtained from tests run under reverse flow conditions.

2.3 MANUFACTURER DUCTWORK LAGGING

A. Sound Seal - B-20 Lag/QFA-9.

B. Approved equal manufacturer prior to bidding.

2.4 DUCTWORK LAGGING

A. Acoustic Insulation: 2 inch thick, quilted, 2.0 lb/sq. ft density glass fiber or mineral wool insulation. R factor 8.0.

B. Covering: Heavy mylar faced re-enforced vinyl barrier sheet with surface weight minimum 0.4 lb/sq ft.

C. Product meeting ASTM E-90 and E-423 requirements.

D. 28 HZ reduction @ 500 OB and 37 HZ @ 1000 OB.

2.5 PACKAGED RTU AND AHU ROOF PENETRATIONS

A. All openings for duct, piping and conduits shall be sealed with an acoustical tape sealant.

1. Design standard is C.R.L. Norseal #V730 with ¼" thickness by 1-1/2" width.

B. In addition, beneath the units and inside the curb install a sound isolation barrier of 3/4" waterproof plywood or cement board, sealed with acoustical tape to the curb structure, pipe and duct.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Support duct silencers rigidly to ductwork.

3.2 SCHEDULES

A. SEE PLANS FOR SIZE AND QUANTITIES.

END OF SECTION

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SECTION 233332 - WOOD DUST COLLECTION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes.

1. Existing collector system relocation.
2. Ductwork and duct fittings.
3. Inlet fittings.
4. Dust elimination and collection devices.
5. Accessories.

1.2 REFERENCES

A. ACGIH - Industrial Ventilation, A Manual of Recommended Practice.

B. ASTM A 569 - Steel, Carbon (0.15 Maximum Percent), Hot-rolled Sheet and Strip, Commercial Quality.

C. AMCA 99 - Standards Handbook.

D. AMCA 210 - Laboratory Methods of Testing Fans for Rating purposes.

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.

G. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Sheet Articles.

H. ASTM A 167 - Stainless and Heat-resisting Chromium-Nickel Steel Plate, Sheet and Strip.

I. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

J. ASTM A 527 - Steel Sheet, Zinc Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

K. IMC-510.

L. NFPA - 68, 69, 652 and 654.

M. PS 15 - Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment.

N. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

O. SMACNA - Round Industrial Duct Construction Standard.

P. SMACNA - Rectangular Industrial Duct Construction Standard.

Q. UL 181 - Factory-Made Air Ducts and Connectors.

R. UL 214 - Tests for Flame-Propagation of Fabrics and Films.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness and sizes of field connections.

C. Product Data: Provide manufacturers literature and data indicating rated capacities, accessories, electrical requirements and wiring diagrams.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit sound power levels for both fan inlet and outlet at rated capacity.

F. Manufacturer's Installation Instruction.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Operation Data: Include instructions for lubrication, motor and drive replacement, spare parts list and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Fans:

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of all equipment in this section.

C. Operation and Maintenance Data: Submit for all equipment in this section.

PART 2 PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Aget.

B. Dust Vent.

C. American Air Filter.

D. Torit.

2.2 SELF-CONTAINED DUST COLLECTORS

A. Relocate and reconnect existing wood dust collector as shown on plans.

B. The dust collector is a completely self-contained unit consisting of a collector housing, fan, motor, filter cartridges and automatic shaker. The unit also includes a funnel bottom for dust disposal.

C. The fan is backwardly inclined for non-overloading operation.

2.3 DUCTWORK AND DUCT ACCESSORIES

A. Materials:

1. Galvanized Steel Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A 90.

B. Ductwork.

1. Fabricate and support in accordance with SMACNA. Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard and ACGIH Industrial Ventilation Manual except as indicated.
2. Construct T's, bends, and elbows with radius of not less than 11/2 times width of duct on centerline.
3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
4. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Prime coat welded joints.
5. Use crimp joints with or without bead for joining round duct sizes 6-inch diameter and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
6. Joints shall be minimum 4 inch cemented slip joint, brazed, or electric welded.
7. Use double nuts and lock washers on threaded rod supports.
8. Duct system conveying velocities shall be determined by the particulate to be exhausted and collected. A nominal design velocity of 3500 to 4500 feet per minute is sufficient for industrial dusts.

9. All duct system pipe and fittings shall be galvanized. All exhaust system ducting shall be round. The interior of all ducts shall be smooth and free from obstructions, especially at joints.
10. Ducts 6-inch diameter and larger shall be spiral duct.
11. Spiral sheet metal pipe shall have the following minimum gauges:

    a. 3"-8" diameter - 22 GA.
    b. 9"-17" diameter - 20 GA.
    c. 18"-24" - 18 GA.

12. Sheet metal elbows shall have the following minimum gauges:

    a. 3"-8" diameter - 20 GA.
    b. 9"-17" diameter - 18 GA.
    c. 18" - 24" - 16 GA.

13. All branches shall enter main at the large end of transition at an angle not to exceed 45 degrees. Branch connection should be to the side of the main duct, not the bottom. Two branches should not enter directly opposite each other. "T" type branches are not acceptable.
14. All ductwork shall be rigidly supported such that there is no unsupported span of ductwork greater than 10 feet. Additionally, branch drops to machine connections should be rigidly supported.
15. Flexible Ducts - 100% pure polyurethane, highly abrasion resistant, PU-coated spring steel mire, antistatic resistance, flame resistance and 0.0275” wall thickness between spirals. Basis of Design is Master Duct-DUR-L-F where flexible hose is required, the section should be kept as straight as possible and the overall length kept to a maximum length of eight feet.
16. Adequate clearances shall be provided between ductwork and ceilings, walls, lights and utilities so as not to hinder installation, maintenance or lighting quality.
17. All machine connections shall incorporate blast gates of two-piece cast construction with fully adjustable sliding gate and set screw for permanent damper setting.
18. Installation shall include connection to equipment hoods. If equipment has no hood, one shall be fabricated and installed to effect proper dust removal from the equipment.

C. Flexible Connectors: UL 214 listed, fire-retardant chloroprene or chlorosulfonated polyethylene impregnated fabric, minimum density 36 oz per sq yd, approximately 6 inches wide, crimped into metal edging strip.

D. Angle rings: Carbon Steel, unpainted, leg out, drilled with bolt holes.

E. Blast Gates: Full collar of cast aluminum or steel, with galvanized steel slide, set screw.

2.4 INLET FITTINGS

A. Fabricate of minimum 16 gauge galvanized carbon stainless steel.

B. Fabricate with hemmed edges, closed corners, and reinforced for span and attachment with duct connection. Provide with enamel coated finish.

2.5 FILTER SEPARATOR

A. Existing filtration system shall be relocated.

2.6 INTEGRATED DUST COLLECTOR INLET BACK DRAFT DAMPER & EXPLOSION VENT

A. Explosion vent shall be relocated per plan.

2.7 SAFETY MONITORING FILTER

A. Explosion housing shall be relocated per plan.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install relocated equipment in accordance with original manufacturer's instructions.

B. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

C. Install fans with resilient mountings and flexible electrical leads.

D. Install flexible connections at inlet and discharge. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

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SECTION 233337 - WELDING FUME COLLECTION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes.

1. Self-Contained Fume Collectors.
2. Industrial exhaust fans.
3. Ductwork and duct fittings.
4. Inlet fittings.
5. Dust elimination and collection devices.
6. Accessories.

1.2 REFERENCES

A. ACGIH - Industrial Ventilation, A Manual of Recommended Practice.

B. ASTM A569 - Steel, Carbon (0.15 Maximum Percent), Hot-rolled Sheet and Strip, Commercial Quality.

C. AMCA 99 - Standards Handbook.

D. AMCA 210 - Laboratory Methods of Testing Fans for Rating purposes.

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.

G. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Sheet Articles.

H. ASTM A167 - Stainless and Heat-resisting Chromium-Nickel Steel Plate, Sheet and Strip.

I. ASTMA 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

J. ASTM A 527 - Steel Sheet, Zinc Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

K. PS 15 - Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment.

L. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

M. SMACNA - Round Industrial Duct Construction Standard.

N. SMACNA - Rectangular Industrial Duct Construction Standard.

O. UL 181 - Factory-Made Air Ducts and Connectors.

P. UL 214 - Tests for Flame-Propagation of Fabrics and Films.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness and sizes of field connections.

C. Product Data: Provide manufacturers literature and data indicating rated capacities, accessories, electrical requirements and wiring diagrams.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit sound power levels for both fan inlet and outlet at rated capacity.

F. Manufacturer's Installation Instruction.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Operation Data: Include instructions for lubrication, motor and drive replacement, spare parts list and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Fans:

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of all equipment in this Section.

C. Operation and Maintenance Data: Submit for all equipment in this Section.

PART 2 PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Camfil GS6 (Standard of Design).

B. Dust Vent.

C. American Air Filter.

D. Torit.

2.2 COLLECTOR

A. The collector(s) shall be an aspirated cartridge, continuously operating and self-cleaning type. Construction shall be of minimum 10-gauge steel panels and 7-gauge steel frame and tube sheet. Major sections shall be modular, bolted construction, for maximum installation flexibility. The collector consists of module section(s) and hopper section(s) with support legs. The collector parts finish shall be individually baked on, durable Dupont® washed prior to powder coat (Triglycidyl Isocyanurate polyester) paint. All carbon steel components are 5-stage acid washed prior to powder coating for maximum adhesion of the paint. Unless otherwise specified, internal frames will be black. There shall be no bare metal surfaces underneath any component. Color to be: Mining gray RAL 7035 (textured finish).

2.3 FILTER MODULE

A. The filter module shall contain six (6) cartridge filter elements with a minimum of SF total filter surface, reverse pulse cleaning system, clean air plenum and cartridge removal / replacement sealing hardware with required support frame and side walls. The filter module shall have a high entry, double wide inlet plenum box with baffles. The inlet baffle consists of three rows of staggered angled baffles installed inside the inlet box to protect the filters from incoming duct and to separate the larger dust particles, which fall directly into the hopper, reducing the load on filters. Prior to the inlet shall be a spark baffle. The box type spark baffle that bolts straight onto the existing inlet. Device is to be one directional and consists of a torturous path for the sparks to go thru. The inlet hole pattern of the spark baffle is the standard inlet design.

B. The pulse cleaning system shall include the blow pipes, internal piping, compressed air header, solenoid valves, and diaphragm valves. The diaphragm valve will be a minimum of 1½" diameter. No more than two cartridges shall be pulsed at a given time. Compressed air header will be external to the clean air plenum. Compressed air will be supplied by others at 85-105 psig. Air will be clean, dry and oil free.

C. Pulse cleaning components shall include blow pipes, internal piping, compressed air header, solenoid valves, solenoid heater, and diaphragm valves. The solenoid housings shall each be fitted with a thermostatically-controlled, 100-watt heater (115V/1-phase) to prevent freeze-ups during cold weather.

D. Cartridge filters shall be installed vertically and easily removed through quick opening access doors. Covers shall be heavy duty formed steel, with mechanically attached seal. The door shall have "lock out" and tagging capability.

1. Air-to-media ratio shall not exceed 3.23 to 1.

E. Cartridges shall be self-positioning and provision shall be made to positively lock the cartridges into place.

2.4 CARTRIDGE MEDIA

A. Cartridge media shall be selected by the vendor to provide 99.99% collection efficiency at 0.5 micron particles. Total emissions at the outlet of the collector shall not exceed 0.002 grains per cubic foot (5 milligrams per cubic meter) based on a maximum inlet grain loading of 10 grains per cubic foot.

B. Cartridges will have twin gaskets on top of the cartridge. The gaskets are of a continuous design; strip and glued gaskets are not acceptable.

C. Filters with upward facing dirty side filter media are not acceptable. Internal to the cartridge shall be an internal media cone, which provides additional media and enhances reverse cleaning. This internal cone shall have a bottom opening in the bottom urethane header, which reduces area of the header and reduces overall can velocity effect. The top of the internal media cone shall have an injection model piece for structural support and reverse airflow cleaning enhancement.

D. Discharge air quality shall be sufficient to recirculate the discharge back into the process building.

2.5 HOPPER SECTION

A. Collector shall have a single hopper with 10” discharge collar. Hopper wall angle shall be 60-degrees. Hopper outlets shall have 10” drum-cover assembly (DCA’s) with latches for NFPA-compliance and two (2) 55-gallon drums. Support legs will allow a clearance of 54” to accommodate DCA’s and drums.

2.6 FAN

A. Fan shall be top-mounted on the dust collector. Motor shall be premium-efficiency with grounding ring for VFD operation, 10 HP, 3,450 rpm, TEFC, 208-V/3-phase/60Hz. Fan wheel shall be backward-inclined. An opposed-blade outlet damper and silencer will be provided on the fan discharge. Silencer will reduce sound levels to less than 85 dBA @ 5 feet. Design performance: 4900 CFM @ 14.5” S.P.

2.7 INTEGRATED CUSTOM CONTROL PANEL

A. All fan controls and cleaning controls shall be housed in a single NEMA-12 cabinet with a single point power connection.

1. Camfil APC Dust Controller Pulse Timed Cleaning System with Digital Differential Pressure Meter.
2. Main Fusible Disconnect With J-Style Current Limiting Fuses.
3. Blower Variable Frequency Drive Controller with Short Circuit and Overload.
4. Type 12 Enclosure Cooling Fan with Exhaust Grill.
5. Industrial Control Transformer.
6. Cleaning Mode Selector (Demand/Off/Continuous).
7. Blower Mode Selector (Remote/Off/Manual).
8. Blower Running Pilot Light.
9. Remote Start Connection for Remote Control of Blower.

10. 100’ Differential Pressure Tubing Kit with Fittings.
11. The Camfil APC Integrated Timer controller with VFD Option provides complete control of the blower during and after startup. It has all the necessary functions for a controlled start of the Camfil APC Dust Collector without the high current loads typically associated with blowers during startup. It also provides the ability to control the blower’s speed resulting in the greatest energy savings and process functionality. It allows the customer to adjust the blower speed as necessary for an accurate and scalable process solution. It provides a single power connection point for the consumer as well as a convenient connection point and control of the pulse cleaning system for a total turnkey package of Dust Collection Controls.
12. Dynamic VFD control, static pressure. For modulating fan speed to maintain static pressure\set point.
13. Solenoid heater termination and transformer upsize.

2.8 UTILITIES

A. Dry compressed air: 5-scfm @ 90-105 psig connected to air header on collector.

2.9 INTERCONNECTIONS

A. Mechanical Contractor shall locate the custom electrical control box inside the Shop Area as indicated with 208 480V/3-ph/60Hz power suitable for the 30- HP fan motor. The interconnections required between the custom electrical control box and the collector will include:

   1. Two (2) wires (16ga or 18ga) in dedicated conduit from controller box to solenoid box - to talk to solenoids. Three (3) wires (16 ga) in a separate conduit (1) solenoid HEATER (1) common (1) ground. Three (3) wires in separate conduit from control box to FAN MOTOR (gauge determined by voltage and HP). Wiring and conduit provided by Division 26.
   2. Two (2) ¼” plastic UV resistant tubes. One (1) to the tap provided on the collector clean air plenum and one (1) to the tap provided on the collector dirty air plenum.
   3. Wiring (in separate conduit) as required by electrical code suitable for operating the 3-phase fan motor. Wiring and conduit provided by Division 26.

B. The mechanical contractor will be responsible for running 1” compressed air piping to collector air header.

2.10 DUCTWORK AND DUCT ACCESSORIES

A. Materials:

   1. Galvanized Steel Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A90.
   2. Steel Ducts: ASTM A569 carbon steel.

B. Ductwork.

   1. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible pressure class-2, Round Industrial Duct Construction Standard,

Rectangular Industrial Duct Construction Standard and ACGIH Industrial Ventilation Manual except as indicated.

2. Construct T's, bends, and elbows with radius of not less than 11/2 times width of duct on centerline.
3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
4. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Prime coat welded joints.
5. Use crimp joints with or without bead for joining round duct sizes 6-inch and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
6. Joints shall be minimum 4 inch cemented slip joint, brazed, or electric welded.
7. Use double nuts and lock washers on threaded rod supports.
8. Duct system conveying velocities shall be nominal design velocity of 3500 to 4500 feet per minute.
9. All duct system pipe and fittings shall be galvanized. All exhaust system ducting shall be round. The interior of all ducts shall be smooth and free from obstructions, especially at joints.
10. Sheet metal pipe shall have the following minimum gauges:

    a. 3"-8" diameter - 22 GA.
    b. 9"-17" diameter - 20 GA.
    c. 18"-24" - 18 GA.

11. Sheet metal elbows shall have the following minimum gauges:

    a. 3"-8" diameter - 20 GA.
    b. 9"-17" diameter - 18 GA.
    c. 18" - 24" - 16 GA.

12. All branches shall enter main at the large end of transition at an angle not to exceed 45 degrees. Branch connection should be to the side of the main, not the bottom. Two branches should not enter directly opposite each other. "T" type branches are not acceptable.
13. All ductwork shall be rigidly supported such that there is no unsupported span of ductwork greater than 10 feet. Additionally, branch drops to machine connections should be rigidly supported.
14. Where flexible hose is required, the section should be kept as straight as possible and the overall length kept to a maximum of 8-feet.
15. Adequate clearances shall be provided between ductwork and ceilings, walls, lights and utilities so as not to hinder installation, maintenance or lighting quality.
16. All machine connections shall incorporate blast gates of two-piece cast construction with fully adjustable sliding gate and set screw for permanent damper setting.
17. Installation shall include connection to equipment hoods. If equipment has no hood, one shall be fabricated and installed to effect proper dust removal from the equipment.

C. Flexible Connectors: UL 214 listed, fire-retardant chloroprene or chlorosulfonated polyethylene impregnated fabric, crimped into metal edging strip, minimum density of 36 oz. per sq. yd. and approximately 6 inches wide,

D. Angle rings: Carbon Steel, unpainted and leg out with drilled bolt holes.

E. Blast Gates: Full collar of cast aluminum or steel, with galvanized steel slide and set screw.

2.11 INLET FITTINGS

A. Fabricate of minimum 16 gauge galvanized steel.

B. Fabricate with hemmed edges, closed corners, and reinforced for span and attachment; enameled finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

C. Install fans with resilient mountings and flexible electrical leads.

D. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Coordinate connection of compressed air to the unit. Have an isolation valve installed in the compressed air line just before leaving the shop thru the exterior wall.

H. Coordinate with Division 26 Contractor all power wiring and conduit from the wall mount control panel to solenoid valve heaters, blower motor and solenoid valves.

I. Manufacturer shall provide a factory authorized and trained technician for control package start-up and owner training.

3.2 FAN AND SEPARATOR SCHEDULE

A. Refer to Plan Sheet Schedule.

END OF SECTION

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SECTION 233355 - NON-METAL FABRIC DUCT SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fabric dispersion system.
2. Fabrication requirements.
3. Design parameters.
4. Suspension hardware.

B. Related Sections:

1. Section 233100 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

1.2 REFERENCES

A. Product must be classified in accordance with the 25/50 flame spread/smoke development requirements of UL723 based on NFPA 90A - 1993, “Installation of Air Conditioning and Ventilating Systems”. In addition, products must be classified in accordance with ICC evaluation Service AC167 and UL2518.

B. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.

D. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

E. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

F. Underwriters Laboratories Inc.:

1. UL 723 - Flame and Smoke Spread.
2. UL 2518 - Air Dispersion System Materials.

1.3 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 and Quality Control.

1. Manufacturer must have documented design support information including duct sizing; vent and/or orifice location; vent and/or orifice sizing; length and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

1.4 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; duct diameters, lengths, airflow, balancing devices, pressure rating and textile permeability.

D. Provide detailed installation instructions for components to be installed.

E. Provide warranty and maintenance documentation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect fabric from damage.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle duct and hanger system in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work where appropriate with BAS control work.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide products manufactured in the United States and subject to compliance with requirements, from one of the following:

1. DuctSox Corporation (Basis of Design).
2. Fab Duct.
3. Q-Sox.
4. Fabric-Aire.
5. NanoSox.
6. K.E. Fabric Aire.
7. Approved equal prior to bidding.

2.2 TEXTILE AIR DISPERSION SYSTEM

A. Hoops (HIS) System: Air diffusers shall be constructed with internal retention system.

1. System shall consist of an internal 360° hoop system, spaced 5’ on center.
2. System shall be installed with a one row suspension system.
3. System attachment to cable supports shall be made using Gliders spaced at 12 inches.
4. Cable suspension.

a. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps and turnbuckle(s) as required.

1) Cable Suspension.

a) Stainless steel cable.

2) Vertical cable support spacing shall be as recommended by manufacturer to have minimal sag of ½” or less between support drops.

B. Textile.

1. TufTex.

a. Construction: Woven polyester with non-permeable coating, fire retardant in accordance with UL 2518.
b. Weight: 8.2 oz/yd² per ASTM D3776.
c. Air Permeability: 0 CFM/ft² per ASTM D737, Frazier.
d. Warranty: 10-years.

2. Textile Color.

    a. Standard: Blue, White, Tan, Red, Green, Silver or Black as selected by Architect.

C. Textile System Fabrication Requirements.

1. UL labeled textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps and mid-sections) and top access zippers for vertical cable safety attachment.
2. Integrated air dispersion shall be specified and approved by manufacturer. (Refer to Plan Sheet for type and other details.).

    a. Linear Vents.

        1) Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 10-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 shall be specified and approved by manufacturer. See plan notes for position of openings and air throw pattern.

    b. 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.
    c. Inlet connection includes zipper for easy removal/maintenance.
    d. Lengths to include required intermediate zippers as specified by manufacturer.
    e. 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.
    f. End cap includes zipper for easy maintenance.
    g. 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. UL labeled textile air diffusers shall be designed for minimum 0.25” water gauge up to 3.10” maximum, with 0.50” as the standard of design.
2. Textile air diffusers shall be limited to design temperatures between 0°F and 180°F.
3. System overall design, diameter, length, airflow, operating static pressure and dispersion system type 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 portion of the mechanical ventilation system.

PART 3 EXECUTION

3.1 INSTALLATION OF FABRIC AIR DISPERSION SYSTEM

A. Install suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

B. Install stainless steel vertical cable supports and any additional steel cross members in roof structure space to maintain minimal sag of ½" or less.

3.2 CLEANING AND PROTECTION

A. Clean external surfaces of dust, dirt and any foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: Cover ends of ducts, which are not connected to equipment or distribution devices at time of ductwork installation, with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If portions of system become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

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SECTION 233405 - HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof - Down Discharge PRV.
2. Roof - Up-blast PRV.
3. Ceiling and In-line Exhaust Fans.
4. Destratification Fans.

B. Related Sections:

1. Section 230700 - HVAC Insulation: Product requirements for power ventilators for placement by this section.
2. Section 230923 - Direct-Digital Control System for HVAC: Controls remote from unit.
3. Section 230933 - Variable Frequency Motor Controllers.
4. Section 233100 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
5. Section 233300 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
6. Section 260503 - Equipment Wiring Connections: Execution and product requirements for connecting fan equipment and damper actuator specified by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:

1. AMCA 99 - Standards Handbook.
2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. American Refrigeration Institute:

1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000-Volts Maximum).

3. NEMA 3R - Outdoor Disconnect.

E. Underwriters Laboratories Inc.:

1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork connection and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

1.9 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two sets of belts for each fan.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Greenheck Fan Co.

B. Loren Cook.

C. Twin City Fan Co.

D. Carnes, Inc.

E. Acme Fan Co.

F. American Coolair, Inc.

G. Creative Metals.

H. Penn/Barry Fan.

I. S. & P. Fan.

J. Captive Aire.

2.2 ROOF EXHAUSTERS

A. Centrifugal Fan Unit: Direct driven, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 16 gauge bird screen; square base to suit roof curb with continuous curb gaskets; secured with cadmium plated bolts and screws. If the fan schedule indicates the use of an ECM type motor, no exceptions shall be allowed. ECM speed controller shall be motor mounted.

B. Centrifugal Up-Blast Fan Unit: V-belt or direct driven as scheduled. Spun aluminum housing, resilient mounted motor, continuous curb rail gasket, secured with bolts on all four sides of curb.

C. Roof Curb: 18 inch high with a wood nailer strip will be provided by the Mechanical Contractor.

1. Curbs shall have 1" rigid insulation included which the contractor shall include in determining thickness of duct wrap needed to meet R-12 code requirement for duct insulation wrap at and near roof penetration rising into down-blast type fan.

D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed or solid state speed controller as noted on Drawings.

E. Backdraft Damper: (If Scheduled) Gravity balanced, aluminum multiple blade construction, felt edged with nylon bearings. Use of a motorized backdraft damper is not allowed.

F. Motor-Operated Damper: Electric operated galvanized multiple blade, low leak construction. Damper to be similar to a Greenheck # VCD-23 low leak damper, with stainless steel side seals, neoprene blade seals and maximum leakage of 4.5 CFM at 1" static pressure through a 12x12 damper area. The typical actuator location shall be outside the air stream for access and maintenance. Damper operator (provided with the fan) shall be 120 V. and shall include a transformer as required and dependent on the fan motor voltage. Division 26 Contractor shall provide wiring to the fan motor disconnect and also to the field mounted damper near the fan throat.

G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

H. For up-blast arrangement provide unit with hinged curb cap for cleaning access at roof.

2.3 IN-LINE AND CEILING EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven, with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge. If the Fan Schedule indicates the use of an ECM type motor, no exceptions shall be allowed. ECM speed controller shall be motor mounted unless specifically noted elsewhere as control signal by BAS or by a remote mounted speed controller.

B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and housing mounted solid state speed controller.

C. Grille: Molded high-impact polystyrene or aluminum with white baked enamel finish.

2.4 SHAFT GROUNDING

A. All fan motors controlled by a VFD shall have a shaft grounding kit installed.

2.5 PROPELLER TYPE - DESTRATIFICATION CEILING FANS AND GUARDS

A. Approved Manufacturers:

1. Leading Edge.

2. Air Master Fan Co.
3. Emerson-Chromalox Co.
4. Enviro-Fan.
5. Heat Recovery Systems (HRS).

2.6 DESTRATIFICATION CEILING FANS

A. Ceiling fans shall be Leading Edge Model #4820-1.

B. Motor shall have heavy duty ball bearing construction. Varnish coated stator laminations and Class "B" insulated copper wire. Standard voltage is 110-115-volt. 60 HZ motor will draw.85 amps at maximum speed of 315 rpm with a power consumption of 86 watts.

C. Blades shall be fabricated from aluminum, finished with a durable baked enamel coating. Blade support arms are of heavy gauge steel to insure correct blade angle. Overall diameter of blades is 48 in. The blades circulate 21,000 cfm at 315 rpm at 20 feet.

D. Downrod shall be 1 in. dia. steel tube to provide for up to 30 in. drop from the ceiling. U-shaped mounting bracket provided.

E. Fans will be started and stopped by BAS.

F. Unit shall include a plug wire for electrical connection to an outlet.

G. Fan color shall be white.

2.7 COMPACT DESTRATIFICATION FAN

A. Approved Manufacturers:

1. Airius - Air Pear.
2. Zoo Fan.

B. General Description:

1. Destratification fan with airflow scheduled at full speed that operates with a variable speed controllable, externally wound, 1-115V motor. Unit shall have fire resistant enclosure and cannot have exposed blades like a traditional propeller ceiling fan. Blades will have a serrated trailing edge and winglet and shall be constructed of PA6 glass-fiber reinforced plastic. Unit shall be variable speed controllable from a direct digital controller via a 0-10 VDC or 4-20 μA interface or via a direct in-line speed controllers. Unit shall include a 200 lb safe working load main cable, attachment system and a separate cable stabilization tether.

C. Motor:

1. ECM drive.
2. 30,000-40,000 hour lubricated service life.
3. Power rating: 115V/60Hz/0.44A.
4. Unit shall include a plug wire for electrical connection to an outlet.

D. Housing:

1. PC ABS Plastic.
2. Fire Resistant 5vB rated.
3. UV Treated.

E. Installation Hardware Included:

1. 8' main cable with 3/8" treaded end and gripper.
2. 12' stabilization tether and gripper.

F. Warranty: 2-year parts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fan and accessories in accordance with manufacturer's instructions for support methods, sound control and vibration control.

B. Provide for speed controllers as scheduled or if an ECM type motor is scheduled, provide and coordinate speed control method with Division 26 or the BAS Sub-Contractor.

C. Mount the PRV damper actuator outside the exhaust air stream in a location that is reasonably accessible by maintenance personnel.

3.2 CEILING DESTRATIFICATION FANS

A. Mount fans as per manufacturer's directions. Provide sufficient mounting brackets and bracing for fans.

B. Fans will be stopped and started by the Building Automation System.

C. Wiring by Electrical Contractor. Coordinate rough-in location to accommodate fan cage which may overlap into roof truss web spaces.

3.3 SCHEDULE

A. See schedule on Drawings.

END OF SECTION

SECTION 233600 - VAV - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Variable volume terminal units.
2. Variable volume regulators.

B. Related Sections:

1. Section 230923 - Direct-Digital Control System for HVAC: Controls remote from unit.
2. Section 230993 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.

1.2 REFERENCES

A. American Refrigeration Institute:

1. ARI 880 - Air Terminals.
2. ARI 885 -Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000-Volts Maximum).

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings indicating airflow, static pressure, heating coil capacity and NC designation. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressure of 1 inch wg.

C. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of units and controls components.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.5 QUALITY ASSURANCE

A. Test and rate air terminal unit performance for air pressure drop, flow performance, and acoustical performance in accordance with ARI 880 and ARI 885. Attach ARI seal to each terminal unit.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with 230923 - Direct Digital Control System.

PART 2 PRODUCTS

2.1 AIR TERMINAL UNIT MANUFACTURERS

A. Manufacturers:

1. Enviro-Tec (E.T.I.).
2. E.H. Price Titus, Inc.
3. Titus, Inc.
4. Nailor Ind.
5. Kruger, Inc.
6. Metal-Aire.
7. Tuttle & Bailey.
8. Approved equal manufacturer prior to bidding. Refer to Division 01.

2.2 SINGLE DUCT VARIABLE VOLUME AIR TERMINAL UNITS

A. Product Description: Pressure-independent, variable-air-volume terminal units for connection to central air systems, with electronic controls and hot water heating coil.

B. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

C. Basic Assembly:

1. Casings: Minimum 22 gauge galvanized steel.
2. Lining: Minimum 0.5 inch thick closed cell foam meeting NFPA 90A requirements and UL 181 erosion requirements.
3. Plenum Air Inlets: Round stub connections for duct attachment or S-slip.
4. Plenum Air Outlets: S slip-and-drive connections.

D. Basic Unit:

1. Configuration: Air volume damper assembly inside unit casing and control components inside protective metal shroud.
2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inch rated inlet static pressure.
3. Mount damper operator to position damper normally open.

E. Hot Water Heating Coil:

1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure and factory installed.
2. Capacity: Based on 160 °F entering water, 140 °F leaving water and 50 percent total air volume at 60 °F entering air.

F. Velocity probe provided by box manufacturer.

G. Sound Ratings: Not to exceed 25 NC at 1" inlet static pressure.

H. Sensor: Refer to Sections 230923.

I. Sequence of Operation: Refer to Section 230993 and plan sheet descriptions.

J. Provide an access door upstream of the heating coil for cleaning and adjusting within the unit from the bottom side.

2.3 DAMPER CONTROLS PROVIDED BY BAS CONTROL CONTRACTOR AND INSTALLED BY BAS CONTROL CONTRACTOR

A. Electric Actuator: 24-volt with remote temperature read and reset capability.

B. Maximum Volume Controller: Electric with calibration pressure taps for high flow limited proportional variable air volume control. Velocity probe provided by the box manufacturer.

C. Velocity Reset Controller: Electric with calibration pressure taps for pressure independent proportional variable air volume control with means for pressure independent compensating for varying inlet static pressure, with minimum and maximum limits set at reset device, mounted in control box. Velocity probe provided by box manufacturer.

D. Sensor: Wall-mounted electronic type with appropriate mounting hardware provided and installed by BAS Contractor.

2.4 TESTS

A. Provide testing of units under provisions of Section 230593.

B. Test run volume dampers and controls. Check sequence of operation and air flow limits at factory prior to shipment.

C. Base performance on tests conducted in accordance with ADC 1062.

D. Automatic flow controller shall be capable of maintaining air flow to within 5 percent of set point with inlet static pressure variations up to 4 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify ductwork is ready for air terminal installation.

3.2 LOCATION OF AIR TERMINAL UNITS

A. A. Mechanical Contractor shall coordinate exact location of VAV reheat boxes with BAS Contractor and all other trades in order to provide reasonable access for maintenance of controls, damper actuator, flow fitting and control valve.

1. 1. Boxes shall be kept within 24" vertically from ceiling for reasonable ladder access through grid. Provide vertical offsets at 30 degrees or less as required.
2. Service area above a light fixture shall be avoided. If the room size dictates such a box or coil location, the service panel and valve shall be near the edge of the light to minimize the need for excessive reaching.
3. Fire protection, hydronic piping and domestic water piping shall not impede access space to control valve, control panel or damper actuator.
4. Electrical conduit and apparatus shall not impede access space to control valve, control panel or damper actuator.

B. If the plan location is not adequate due to any of the afore mentioned items, the Mechanical Contractor shall inform the Engineer so that the location can be adjusted. Relocation of boxes deemed to have inadequate access by the Engineer shall be the responsibility of the Mechanical Contractor.

3.3 INSTALLATION

A. Connect to ductwork in accordance with Section 233100.

B. Install ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork and do not support from roof decking unless specifically approved by the Structural Engineer.

D. Support air terminal units connected by flexible duct independently of flexible duct.

E. Install transition piece to match flexible duct size to inlet or outlet of variable air volume terminal. Provide a maximum of four (4) foot long flexible duct connection unless code requires direct duct connecting due to fire barrier or fire-rated area penetrations.

F. Install 1-inch thick lined ductwork downstream of units for a minimum of five feet or more as shown on plan. Refer to Section 230700 for liner insulation type.

G. Coordinate installation of control components with the BAS Contractor before hanging boxes.

H. Install insulation and jacket over VAV reheat or duct mounted reheat coils. Refer to section 230700.

I. Provide a filter (ALERTON VAV-FILTER) in the air tubing between the VAV box pick-up ring and the tubing connection at the VAV controller.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Re-set air volume with damper operator attached to assembly allowing airflow range modulation from 100 percent of design airflow to 0 percent full airflow. Set units with heating coils for minimum 50 percent of full airflow in heating mode and 15 percent of full airflow in cooling mode.

3.5 SCHEDULES

A. Refer to schedule on Plan Sheet.

END OF SECTION

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SECTION 233700 - AIR OUTLETS AND INLETS AND RELATED CURBS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Diffusers.
2. Registers.
3. Grilles.
4. Door grilles.
5. Louvers.
6. Louvered penthouses.
7. Roof hoods.
8. Goosenecks.
9. Smoke relief vents.
10. Roof curbs.

B. Related Sections:

1. Section 233300 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application and noise level.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - CEILING DIFFUSERS/GRILLES AND REGISTERS

A. E. H. Price Company.

B. Titus Manufacturing Co.

C. Hart & Cooley.

D. Metal-Aire.

E. Tuttle & Bailey.

F. Nailor.

G. Krueger.

2.2 SQUARE CEILING DIFFUSERS

A. Square, fully adjustable discharge pattern, multi-tier type diffuser to discharge air in 360 degree pattern with air pattern control blades. Noise criteria levels shall not exceed NC-25 in vertical discharge position.

B. Adjustable air flow shall not be allowed by use of adjustable core position. Individual adjustable vanes shall be provided on all four sides and shall be accessible from the unit face.

C. Fabricate of steel with baked enamel off-white finish.

D. Provide with damper adjustable from diffuser face.

E. Lay-In, Inverted T-bar type.

F. Design standard - E.H. Price #SCDA.

2.3 ROUND DIFFUSERS (ADJUSTABLE INDUSTRIAL STYLE)

A. Round, 3-position, adjustable discharge pattern, multi-core type diffuser to discharge air in 360° pattern, with safety chain. Noise criteria levels shall not exceed NC-25 in vertical discharge position.

B. Fabricate of steel with baked enamel off-white finish.

C. Provide with damper adjustable from diffuser face.

D. Units shall be constructed to resist damage from incidental contact from balls and other projectiles encountered in Gymnasiums.

E. Design Standard - E.H. Price #RID.

2.4 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Fixed grilles of 1/2 x 1/2 x 1/2 inch egg crate bars.

B. Fabricate 7/8 inch margin frame with countersunk screw for surface mounting. No screw holes in lay-in frame for suspended grid ceilings.

C. Fabricate of aluminum with factory white finish.

D. At constant volume locations, when a branch duct damper isn't installed, provide an integral, gang-operated opposed blade damper with removable key operator. The Mechanical contractor shall verify these locations and order the grille / register mounted dampers as required for balancing.

E. On VAV systems dampers are not required at the return air grilles.

F. Design Standard - E.H. Price #Series 80.

2.5 WALL SUPPLY REGISTERS/GRILLES

A. Streamlined and individually adjustable blades, depth of which exceeds 3/4" maximum spacing with spring or other device to set blades, vertical face, double deflection.

B. Fabricate 1-1/4" margin frame with countersunk screw mounting and gasket.

C. Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, with factory prime coat finish.

D. Provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

E. Design Standard - E.H. Price #520D.

F. When referred to as heavy-duty type, blades shall be front pivoted, with device to securely lock blades after adjustment. Frame shall be 18 gauge and blades shall be 14 gauge.

2.6 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Streamlined 40° blades, 3/4" depth minimum. 1/2" maximum blade spacing with spot weld, "U" channel or other device to permanently set blades, horizontal face.

B. Fabricate 1-1/4" margin frame with countersunk screw mounting.

C. Fabricate of steel with 20 gauge frames and 22 gauge blades, with factory primed coated finish.

D. Damper: Integral, gang-operated opposed blade dampers with removable key operator, operable from face.

E. Design Standard - E.H. Price #535.

F. When referred to as heavy-duty type, blades shall be welded in place to be immobile. Frame shall be 18 gauge and blades shall be 14 gauge. Vertical mullions shall be installed with a maximum spacing of 8 inches O.C. Blades shall be set at 0° and shall be spaced at 3/8" O.C.

G. Design Standard - E.H. Price #90.

2.7 SPIRAL DUCT SUPPLY GRILLES

A. Grilles designed for mounting on exposed round or spiral duct curvature with streamlined and individually adjustable blades, depth of which exceeds 3/4" maximum spacing with spring or other device to set blades, vertical face and double deflection.

B. Fabricate 1-1/4" margin frame with countersunk screw mounting and gasket.

C. Fabricate of painted steel with 20 gauge minimum frames and 22 gauge minimum blades, with factory prime coat finish.

D. Provide integral, rod-operated air scoop with removable key operator, operable from face.

E. Design Standard - E.H. Price #SDGE.

2.8 ACCEPTABLE MANUFACTURERS - LOUVERS

A. Dowco - Model #DBF-04 06 Galvanized.

B. Greenheck, Inc.

C. Air Control Products.

D. Ruskin Co.

E. Carnes, Inc.

F. Cesco Products.

G. Arrow United.

H. Creative Metals (Wall Louvers).

I. American Warming & Ventilating.

J. Louvers & Dampers, Inc.

K. Kees.

L. Pottorff.

M. NCA, Inc.

N. Shoemaker.

O. Nailor.

2.9 LOUVERS

A. Provide 4 inch deep louvers with blades on 40 degree slope with center baffle return bend concave slope blades, heavy channel frame, inside birdscreen with 1/2 inch square mesh. Provide drainable blades and gutters on all louvers.

B. Fabricate of 16 gauge galvanized steel, welded assembly, with factory enamel coat finish. Color selection by architect.

C. Mounting: Furnish with interior angle flange and screw holes in jambs or masonry strap anchors for installation.

2.10 MANUFACTURERS - LOW SILHOUETTE HOODED INTAKES AND RELIEFS

A. Greenheck.

B. Louvers & Dampers, Inc.

C. Loren Cook.

D. Dowco, Inc.

E. Kees.

F. ACME.

G. Penn Ventilator.

H. Twin City Fan.

2.11 LOW SILHOUETTE HOODS

A. Fabricate air inlet or exhaust hoods in accordance with SMACNA Low Pressure Duct Construction Standards: Model FGI and FGR as manufactured by Greenheck.

B. Fabricate rectangular slope sided hood of 0.064" aluminum and provide unit with snow stop, 1/2" x 1/2" galvanized bird screen, thermal insulation under removable cover. Provide aluminum gravity relief back draft dampers in relief/exhaust throat.

C. Motor Operated Damper: Provide by BAS contractor.

D. Roof Curb: Provide 18” high curb with wood nailer strip for relief hoods and 30” high curb with wood nailer strip for intake hoods. Curbs shall include 1-1/2”-inch rigid insulation which the mechanical contractor shall include in their calculations to meet the energy codes R-12 duct wrap requirement at and near the roof penetration. Size curb and attached device cap to accommodate the additional insulation thickness.

2.12 GOOSENECKS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards of minimum 18 gauge galvanized steel. Prime and paint in field.

B. For round ducts over 6” diameter and all rectangular ducts, mount on minimum 12 inch high curb base.

C. Discharge shall be a minimum of 20" above the roof.

D. For round duct 6" diameter and smaller a high cone rubber boot with storm collar above may be used.

E. Provide a 12” high curb with nailer strip for sheet metal flashing cone connection at duct penetration of roof.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

B. Where the grille relates visually to another component of the building construction, the grille must be properly centered or spaced to conform with that element of the building. Where grilles occur in the ceiling which is modular such as tile, etc., the grille must be installed to line up with the normal ceiling lines.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry and lighting arrangement. Control joints in walls and ceilings shall not be intersected by grille, register or diffuser.

D. The sheet metal installer shall hold off on his final length of duct where such adjustments must be made in the placement of the grille so that the final location will line up with the rest of the building elements.

E. All fixed grilles and registers shall be installed with the blades in the position which will be most effective in obscuring the duct beyond from view, and where the duct surface remains visible from any normal viewing angle, the internal surfaces of the duct shall be painted dull black with suitable material.

F. Install ductwork to ceiling diffusers with air tight connection. Provide either a rigid elbow at the diffuser throat or a minimum 2” sheet metal collar for flexible duct connection.

G. Division 01 - Administrative Requirements: Coordination and project conditions.

H. Verify that ceiling, roof and wall systems are ready for installation.

I. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille and register assembly. Refer to Section 233300.

J. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Division 09.

3.2 AIR OUTLET AND INLET SCHEDULE

A. See Schedule on Plans.

3.3 ROOF CURBS

A. General Trades contractor shall provide and install wood blocking under curb perimeter as required to level the curb. Refer to plan details for minimum clearance from finished roof surface to curb cap. Adjust blocking height as required to meet those minimums.

B. Mechanical Contractor shall provide curbs that can accommodate the energy code requirement of R-12 insulation at all points outside the building envelope.

C. Provide insulation within the curb (either with internal liner or external wrap insulation around the duct throat) as required to provide the energy code minimum of R-12 total value.

D. Provide curbs for intake hoods, relief hoods and goosenecks to the General Trades Contractor for installation.

3.4 LOUVERS

A. Slope bottom portion of outside air, relief air and exhaust air ductwork downward toward bottom of louver connection so any water or snow infiltration drains out thru bottom gutter of louver with drainable blades. Seal all joints water tight.

END OF SECTION

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SECTION 234000 - HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Disposable, extended area panel filters.
2. Extended surface high efficiency cartridge filters.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 850 - Commercial and Industrial Air Filter Equipment.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

C. Military Standardization Documents:

1. MIL MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods.

D. Underwriters Laboratories Inc.:

1. UL 586 - High-Efficiency. Particulate, Air Filter Units.
2. UL 867 - Electrostatic Air Cleaners.
3. UL 900 - Air Filter Units.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to ARI 850 Section 7.4.

B. Dust Spot Efficiency: Plus or minus 5 percent.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings Product Data: Submit data on filter media, filter performance data and dimensions.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

1.6 EXTRA MATERIALS (IN FOR MSU)

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. At substantial completion all equipment shall have one set of clean, pre-filters and final filters installed and an additional set stored nearby for the owners first filter change.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Camfil Farr Filters.

B. Tri-Dem Filters.

C. Cambridge Filters.

D. American Air Filters.

E. Purolator.

F. Flanders Filters.

G. Scan Filters.

2.2 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2. One (1) inch thick pleated woven cotton, factory sprayed with flameproof, non-drip, non-volatile adhesive, supported and bonded to cardboard grid and enclosed in a cardboard frame.

B. Rating: 350 FPM face velocity, 0.16 inch WG initial resistance, 0.40 inches WG recommended final resistance. 20 percent efficiency and MERV-6 rating based on ASHRAE 52.2.

C. Model: 20/20 manufactured by Camfil Farr.

D. These units to be used in cabinet unit heaters or similar equipment.

2.3 DISPOSABLE, MEDIUM-EFFICIENCY EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 2 Pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to cardboard grid; enclosed in 2-inch thick cardboard frame.

B. Rating: ASHRAE 52; 25-30 percent dust spot efficiency, 90-92 percent weight arrestance; maximum 500 FPM face velocity, 0.30 inch WG initial resistance, 0.80 inch WG recommended final resistance. 30 percent efficiency and MERV-8 based on ASHRAE 52.2.

C. Model: 30-30 manufactured by Camfil Farr with 90 percent efficiency on 4.0 micron and larger.

D. These units to be used in packaged RTUs as pre-filters.

2.4 DISPOSABLE, HIGH-EFFICIENCY EXTENDED AREA FINAL FILTERS

A. Media: UL 900 Class 2, polypropylene media in mini-pleat configuration for higher strength, supported by and bonded to a cardboard frame. Refer to plan schedules for filter thickness.

B. Rating: ASHRAE 52.2; 80-85percent dust spot efficiency, 92-96 percent weight arrestance, maximum 375 FPM velocity, 0.24 inch WG initial resistance, 0.75 inch WG recommended final resistance for 4” thick filter. 85 percent efficiency and MERV-13 based on ASHRAE 52.2.

C. Model: Ultrasolve 80-85 manufactured by Camfil Farr.

D. These units to be used in packaged RTUs as final filters.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install filters with felt, rubber, or neoprene gaskets to prevent passage of unfiltered air around filters.

B. Do not operate fan system until temporary filters are in place. Replace temporary filters used during construction and testing, with clean set and store the extra sets in location designated by owner.

END OF SECTION

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SECTION 235120 - HIGH-EFFICIENCY BOILER CHIMNEYS

PART 1 GENERAL

1.1 SUMMARY

A. Work Results:

B. Principal Products:

C. Section Includes.

1. Manufactured chimneys for gas-fired, condensing equipment.

D. Related Sections.

1. Section 235122 - High-Efficiency Boilers.

1.2 REFERENCES

A. ANSI/ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ANSI Z21.66 - Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

C. ANSI Z223.1 (NFPA 54) - The National Fuel Gas Code.

D. ASHRAE - Handbook, Equipment Volume, Chapter "Chimney, Gas, Vent and Fireplace Systems."

E. ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent) Hot-Rolled Commercial Quality.

F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

G. UL 103 - Standard for Factory Built Low Heat Chimneys.

H. UL 441 - Standard for Gas Vents.

I. UL 641 - Standard for Low Temperature Venting Systems.

1.3 DEFINITIONS

A. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

B. Vent: That portion of a venting system designed to convey flue gases horizontally and vertically, directly outdoors from a vent connector or from an appliance when a vent connector is not used.

1.4 DESIGN REQUIREMENTS

A. Factory-built vents and chimneys used for venting high-efficiency condensing appliances. Products shall conform to the requirements of NFPA 54 and NFPA 211, and shall comply with UL 1738, ULC S636 Standard for Venting Systems for Category II, III and IV Gas-Burning Appliances, and all other applicable standards.

B. All flue-gas carrying components of the vent system shall be obtained through one source.

1.5 SUBMITTALS

A. Refer to Division 01 - Submittal Procedures.

B. Submit shop drawings indicating general construction, installation instructions, dimensions, weights, support and layout drawing of entire system.

C. Submit product data indicating factory built chimneys, including dimensional details of components, flue caps and complete system, weights and connection requirements. Provide correspondence from the boiler manufacturer that the chimney system will meet the specific boiler application.

D. Provide draft calculations for the proposed system installation. Draft calculations shall be reviewed with boiler manufacturer prior to submittal to engineer to confirm proper system design.

E. All venting materials shall be provided by and represented by the same sales.

F. Manufacturer's Installation Instructions: Submit assembly, support details and connection requirements.

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

H. Installer: Company specializing in performing Work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS: FORCED INDUCED DRAFT GAS CHIMNEYS

A. Jeremias.

B. Selkirk Metalbestos.

C. Stacks.

D. Metal Fab.

E. Security Chimneys.

F. Schebler.

G. Approved equal manufacturer prior to bidding. Refer to Division 01.

2.2 INDUCED DRAFT BOILERS

A. All venting materials shall be provided by and represented by the same sales.

B. The factory-built modular stack system, consisting of connector(s), manifolds(s) and vertical stack shall be laboratory tested and listed by Underwriters Laboratories for use with building heating equipment and appliances which produce exhaust flue gases at temperatures not exceeding 550° F under continuous operating conditions when burning gaseous, fuels in accordance with UL 1738 and NFPA 54 and NFPA 211. The system shall be designed and installed to be gas and air tight by using factory supplied vee bands and sealant. The system shall be designed to compensate for all flue gas induced thermal expansion.

C. The use of a single-wall stack shall not be allowed. Interior double-wall venting does not require insulation.

D. Roof penetration(s) shall be suitable for those materials used in the roof construction. A thimble shall be installed at each roof opening as an integral component part of a ventilated thimble assembly or a roof support assembly.

E. All stacks components penetrating the roof and above the roof shall be double wall and shall have a 304 or greater type stainless steel outer jacket, AL29-4C stainless steel inner jacket, 1" insulation and stainless steel accessories. The termination shall include a factory-supplied closure band and exit cone for higher velocity discharge. Chimney caps shall not be used in condensing applications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Refer to boiler manufacturers installation instructions for additional appliance specific requirements. Consult with engineer if appliance manufacturer’s requirements differ from these specifications.

B. Install in accordance with recommendations of ASHRAE -Handbook, Equipment Volume, Chapter "Chimney, Gas, Vent, and Fireplace Systems", and ANSI Z223.1 (NFPA 54).

C. Support vent pipe from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.

D. Install chimney and stack vertically plumb.

E. At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, chimneys or stacks.

F. Provide double wall insulated stack at all roof wall penetrations and exterior locations.

G. Mechanical Contractor shall provide a 12” high curb for installation by general trades contractor.

H. All flashing, curb and curb caps that are located outside the building shall be manufactured of 316 stainless steel to provide a long-lasting corrosion-resistant installation. Carbon steel, galvanized or aluminized steel materials are not acceptable options.

I. Vent discharge shall extend a minimum of seven (7) feet above the flat roof surface. Stacks that are 7’-0” or less may be installed without the use of guy wire supports if the chimney is rated for this condition. However, include the use of guy wires if the chimney system manufacturer requires the chimney to be supported with guy wires. Mechanical Contractor and manufacturer representative shall determine the need for guy wires and provide them if required by the chimney manufacturer.

J. Coordinate vent discharge location with combustion air intake openings and position both per manufacturer’s installation manual. Vent shall be a minimum of five (5) feet above the combustion air intake height and ten (10) feet horizontally from the combustion air intake. Typically, combustion air intakes will be at least 36” above the roof surface.

K. Provide for a minimum of ten (10) foot clearance from any adjoining wall or building. If the chimney stack terminations are located within the 10’ circumference of a wall or building portion that is greater than 3’ above the vents roof opening, the chimney system shall be extended at least 3’ above that adjoining wall or building portion.

L. Pitch vent piping back toward appliance from the 88 degree elbow to allow any condensate that forms in the stack to run to the stack drain located near the appliance. If a tee is used at

the base of the stack it shall be a drain tee and the Mechanical Contractor shall provide a 3/4" stainless steel pipe from there to the neutralizer tank.

M. If the stack roof penetration is closer than twenty (20) feet horizontally or ten (10) feet vertically to any ventilation outside air intake, the stack shall be extended at least eight (8) feet above the intake.

N. Refer to boiler manufacturer's installation instruction and provide for any other requirements that are either more stringent or not recommended by the boiler manufacturer than those listed above. With any and all changes to this specification due any outside reason, please consult with the engineer overseeing this specific installation.

3.2 SCHEDULE

END OF SECTION

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SECTION 235122 - HIGH-EFFICIENCY STAINLESS STEEL CONDENSING BOILERS

PART 1 GENERAL

1.1 SUMMARY

A. Boiler package including chimney venting and in-line circulator pump which shall all be provided by the boiler representative.

B. Section Includes:

1. High-efficiency condensing boilers.
2. Boiler control panel.
3. Hot water boiler trim.
4. Natural gas fired burner.
5. In-line circulator (with integral VFD or ECM drive).
6. High-efficiency boiler venting.

C. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
2. Section 221100 - Facility Water Distribution: Execution requirements for cold water piping connections to boilers specified in this section.
3. Section 221123 - Facility Natural-Gas Piping: Execution requirements for natural gas piping connections to boilers specified in this section.
4. Section 232113 - Hydronic Piping: Execution requirements for hot water piping for piping connections to boilers specified in this section.
5. Section 235120 - Chimneys for High Efficiency Boilers: Execution requirements for breeching, chimney, and stack connections to boilers specified in this section.
6. Sections 230923 thru 230993 - Controls, Instrumentation and Sequence of Operations.
7. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to boilers specified in this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.13 - Gas-fired Low Pressure Steam and Hot Water Boilers.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:

1. ASME Section IV - Boiler and Pressure Vessel Code - Heating Boilers.

D. Hydronics Institute:

1. H.I. Heating Boiler Standard - Testing and Rating Standard for Heating Boilers.

E. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000-Volts Maximum).

F. National Fire Protection Association:

1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
2. NFPA 54 - National Fuel Gas Code.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit capacities and accessories included with boiler. Include general layout, dimensions, size and location of water, fuel, electric and vent connections, electrical characteristics, weight and mounting loads.

C. Test Reports: Indicate boilers meet or exceed specified performance and efficiency. Submit results of combustion test.

D. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

E. Manufacturers Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Conform to ASME Section IV and ANSI Z21.13 Code for construction of boilers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

B. Boiler Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with H.I. Heating Boiler Standard.

C. Gas Train and Safety Controls: Conform to requirements of Factory Mutual (FM) and state of Minnesota.

D. Unit Certification: AGA and ETL or UL certified.

E. Conform to applicable state code and N.E.C. for internal wiring of factory wired equipment.

F. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept boilers and accessories on site in factory shipping packaging after inspection for damage.

C. Protect boilers from damage by leaving packing in place until installation.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. The pressure vessel shall be guaranteed against thermal shock for 10 years when utilized in a closed loop hydronic heating system with a temperature differential of 170°F or less. The pressure vessel and exhaust assembly shall be covered by a five year warranty against flue gas corrosion. All other components are covered by a two year (24 month) warranty.

1.9 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Maintenance service.

B. Perform maintenance work using qualified personnel under supervision and in direct employ of boiler manufacturer's representative or original installer.

1.10 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 GENERAL DESCRIPTION

A. Contractor shall furnish and install natural gas fired high efficiency condensing type Hot Water Boilers, as approved prior to bid date/addenda.

B. Approved Manufacturers:

1. Aerco - Benchmark.
2. Lochinvar - Crest.

3. Approved equal manufacturer prior to bidding. Refer to Division 01. Prior approval equipment must fit into designated space without additional work.

C. Each unit shall be condensing type complete with boiler fittings and automatic controls. The boilers (with all wiring) shall be completely factory assembled as a self-contained unit with all required wiring. Each boiler will be neatly finished, thoroughly factory fire-tested and properly packaged for shipping. The boiler design and construction shall be in accordance with Section IV of ASME code for hot water heating boilers with a maximum working pressure of 160 PSI. The boiler shall comply with AGA, ASME CSD-1 and Minnesota state code requirements.

D. Each boiler shall be provided with a full line size, 100% dead-end, lock-up type gas regulator for field installation.

E. Each boiler shall have a variable-speed, (ECM or VFD) circulation pump provided as part of the boiler equipment package for field installation by the Mechanical Contractor. Refer to section 23 2123 and plan sheet pump schedule for capacities.

F. Each boiler shall have high-efficiency stainless steel or polypropylene chimney venting system provided as part of the complete boiler equipment package.

G. Draft Controls - Each unit shall have electronic draft controls provided so maximum efficiency is maintained at all points along the unit's modulation range. No exceptions to this option are allowed.

2.2 MANUFACTURED UNITS

A. Furnish and install as shown on manufactured plans and operation and maintenance manuals, with all applicable codes and authorities having local, state and federal jurisdiction. The boiler manufacturer must publish known part load value efficiencies; the thermal efficiency must increase as the firing rate decreases. The accuracy of these published efficiencies must be reviewed and confirmed by Underwriter's Laboratories, Inc. The boiler control panel shall be proprietary in design and incorporate the functions of temperature control, combustion safeguard control, message annunciation, and fault diagnostic display, on individual field replaceable circuit boards mounted within a single housing. The boiler shall have an ASME approved relief valve setting of 45 psig.

2.3 CONSTRUCTION

A. Boiler modules shall be natural gas-fired, condensing fire tube design with a modulating forced draft power burner and positive pressure vent discharge.

B. Modulating Air/Fuel Valve and Burner: The boiler burner shall be capable of a minimum 20 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The burner shall produce <30ppm of NOx corrected to 3% excess oxygen. The burner shall be metal fiber mesh covering a stainless steel body, with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and natural gas input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any

field adjustment. A cast aluminum venture with integral mixer shall be utilized to ensure the optimum premix of air and fuel between the air/fuel valve and the burner.

C. Pressure Vessel/Heat Exchanger: The boiler shall be capable of handling return water temperatures down to 40F without any failure due to thermal shock or fireside condensation. The heat exchangers shall be ASME stamped for a working pressure not less than 160 psig. The boiler water connections shall be flanged and 150 psig ANSI rated. The pressure vessels are constructed of SA53 carbon steel, with a 0.25" thick wall and 0.25" thick upper head. Inspection openings in the pressure vessels shall be in accordance with ASME Section IV vessel code. The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases. The heat exchangers shall be constructed of 316L stainless steel fire tubes and tube sheets with a one-pass combustion gas flow design. The fire tubes shall be 5/8" OD with no less than 0.065" wall thickness. The upper and lower stainless steel tube sheets shall be no less than 0.313" thick. The pressure vessel/heat exchangers shall be welded construction. The heat exchangers shall be ASME stamped for a working pressure not less than 160 psig. Access to the tube sheets and heat exchangers are available by burner and exhaust manifold removal. Minimum access opening shall be no less than 10 inch diameter.

D. Exhaust Manifold: The exhaust manifold shall be of corrosion resistant cast aluminum for flue connection. The exhaust manifold shall have a gravity drain for the elimination of the condensation with collecting reservoir. Refer to plan and schedule for size.

2.4 BOILER CONTROLS

A. The boiler manufacturer shall supply as part of the boiler package a completely integrated digital system to control all operating and energy input of the multiple boiler heating plant. The control system shall be comprised of a micro-processor based control to communicate with the boilers via the RS-485 port. Refer to control sequences for more information on control system integration requirements.

B. The boiler shall utilize a 24 VAC, or industry similar control circuit and components. The control system shall have a display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The boiler shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (standard); outlet water temperature sensor (dual thermistor); return water temperature sensor; outdoor air sensor, flue temperature sensor (dual thermistor); high and low gas pressure switches, low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.

C. The boilers each shall feature the manufacturers standard control, or similar, which is standard and factory installed with an 8” liquid crystal touch screen display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities and PC port connection. A secondary control that is field mounted outside or inside the appliance is not acceptable. The boiler shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The boiler shall have a built-in “Cascade” to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation

of lead boiler every 24 hours. The boiler shall be capable of controlling an isolation valve (valve shall be provided by the boiler manufacturer) during heating operation and rotation of open valves in standby operation for full flow applications. The control must be equipped with standard Modbus communication protocol. The boiler shall have an optional gateway device installed into each of the boilers which will allow integration to the Building Automation System via the BACnet MSTP protocol.

D. The control system for the Aerco Benchmark boilers shall be the “C-More” system. The control system for the Lochinvar Crest boilers shall be the “Smart-Touch CON-X-US” system. The systems shall provide all necessary system control functions and shall be integrated with the building automation system to operate and execute the specified sequence of operation.

2.5 CONTROLS INTER-OPERABILITY

A. The boiler control panel shall utilize BACnet to interface with third party building automation systems. When the Building Automation System (BAS) does not have BACnet protocol capability and interoperability is required, the boiler manufacturer shall provide a BACnet Gateway to act as interface/translator to the BAS.

B. Boiler manufacturer shall be responsible for providing all necessary assistance required to ensure interoperability between boiler controls and BAS.

C. Approved equal manufacturer’s control shall meet or exceed all capabilities of the “C-More” or “Smart-Touch CON-X-US” control package.

2.6 INSTALLATION

A. All aspects of installation of Boiler Plant shall be in strict accordance with manufacturer instructions. The vent system must conform to all manufacturer recommendations and shall utilize UL Listed stainless steel AL-29-4C. The vent must be sized in accordance with boiler manufacturer recommendations. Boiler Plant piping shall be field constructed of materials as specified. Each boiler shall have a circulator with an ECM or VFD controlled by the boiler unit controls to operate whenever the boiler is calling to fire Each boiler shall have individually isolating shutoff valves for service and maintenance.

2.7 HOT WATER BOILER TRIM

A. Provide pressure gauge and thermometer and ASME rated pressure relief valves.

B. Provide low water cut-off with manual reset to automatically prevent burner operation when boiler water drops below safe level.

C. Provide the following standard trim:

1. Stainless steel condensate receiver pan.
2. Low air pressure switch.
3. Blocked flue detection switch.
4. Flow switch (factory-mounted and wired).
5. Modulation control.
6. Air inlet filter.

7. Inlet/outlet temperature display.
8. Full digital text display for all boiler series of operation and failures.
9. Variable frequency drive or ECM driven combustion air fan.
10. Motor operated boiler isolation valve for field installation in boiler return piping.
11. Neutralizer tube from JJM Alkaline Technologies. Verify unit size requirement based on BTUH firing rate, per manufacturer's requirements.
12. Dead-end Lock-up regulator.
13. In-line circulator for each boiler with integral VFD or ECM drive.

2.8 MOTORS

A. Refer to Division 23 Section "Motors" for factory-installed motors.

B. Boiler Blower Motor: Open drip-proof motors were satisfactorily housed or remotely located during operation. Blower motor shall be externally mounted for ease of service.

C. In-line circulator. Refer to pump schedule for capacities and voltage requirements.

2.9 CONTROLS

A. The boiler temperature reset, fault alarms and lead/lag shall be controlled under Sections 230923 thru 230993. Boiler manufacturer shall coordinate control components required for proper boiler operation with the Temperature Control Contractor. The control items, (required beyond those listed under combustion equipment), wiring and installation shall be the responsibility of Sections 230923 thru 230993.

PART 3 EXECUTION

3.1 INSTALLATION

A. If necessary, assemble the boiler from knock-down configuration after transporting into Boiler Room. Perform state of Minnesota required hydro-test on boiler after installation and assembly in accordance with the following:

1. Pressure test before connecting natural gas piping, electrical connections and controls.
2. Install boiler drain and pressure gauge.
3. Plug remaining openings.
4. Fill boiler with water and vent air.
5. Pressure test to 1-1/2 times working pressure for water boilers for 10 minutes without leak(s) occurring.
6. Repair leak(s) and retest.
7. After successful test, drain the unit and remove plugs from openings that are used for piping connections and controls.

B. The venting system and control wiring shall be provided with the boiler by the same sales representative. The same sales representative shall be responsible for coordination of power wiring, control wiring, gas piping connection, water connection, venting system and combustion air intake with Div. 23, Div. 26 and BAS contractors.

C. Install boilers plumb and level, to plus or minus 1/16 inch over boiler base.

D. Maintain manufacturer's recommended clearances around and over boilers.

E. Install boiler on new 3-1/2” tall concrete housekeeping pad.

F. Connect natural gas piping to boiler, full size of boiler gas train inlet. Arrange piping with clearances for burner removal and service. Locate gas pressure regulator at least 10’-0” away from boiler gas inlet.

G. Connect hot water piping to supply and return boiler connections.

H. Install the following piping accessories. Refer to Section 232113.

1. On supply:

    a. Thermometer well for temperature controller.
    b. Thermometer well and thermometer.
    c. Well for control system temperature sensor.
    d. Nipple and flow switch.
    e. Pressure gauge.
    f. Shutoff valve.

2. On return:

    a. Thermometer well and thermometer.
    b. Well for control system temperature sensor.
    c. Pressure gauge.
    d. Shutoff valve.
    e. Check valve.
    f. Flexible pipe connector.
    g. Strainer with insulation valves on both sides and a full size flashing valve package.
    h. Install a pressure gauge on each side of the strainer.

I. Verify that all the following piping accessories on natural gas piping connections are installed. Refer to Section 231123.

1. Full size gas pipe filter.
2. Locate gas regulator 10 feet from boiler gas train connection. Install a pressure gauge on high pressure side and low pressure side of this regulator.
3. Strainer.
4. Pressure gauge.
5. Shutoff valve.
6. Check valve.
7. Pressure reducing valve.

J. Install discharge piping from relief valves and drain valves to nearest floor drain.

K. Install boiler trim and accessories furnished loose for field mounting.

L. Install electrical devices furnished loose for field mounting.

M. Install control wiring between boiler control panel and field mounted control devices.

N. Connect flue to boiler outlet, full size of outlet.

O. Prior to installation of boiler chimney, the installing contractor shall be responsible for verifying the equipment layout and the boiler manufacturer's requirements for separation between the chimney and boiler combustion air inlet opening. If necessary, additional chimney height shall be provided as required to prevent re-circulation of products of combustion to the combustion air inlet opening.

P. All wiring required for boiler system installation shall be provided and installed by the boiler supplier.

Q. Any disassembly of components and installation after boiler placement or installation of loose shipped components shall be the boiler/burner manufacturer's responsibility. This shall include gas train, control wiring, power wiring, etc.

3.2 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 components, assemblies and equipment installations, including connections, and to assist in testing.
2. Boiler manufacturer to provide three (3) factory field start-up visits from a factory-authorized service technician as follows:

    a. FIRST SERVICE - visit after equipment is installed and ready for the initial start-up. This visit will include a check-out of the initial installation details and provide assistance in starting the boiler for the first time.
    b. SECOND SERVICE - visit will occur after the boilers have been in service for a period of time and the outside air temperature is consistently 20°F or colder. This visit will include an equipment check-out and will be used to fine-tune system operating parameters to site-specific requirements.
    c. THIRD SERVICE - visit will occur approximately 11-months after initial boiler start-up (prior to second season start-up). This visit will include a check-out of the boilers to ensure continued proper operation and to provide additional owner trainer.
    d. Each startup report will provide a report with equipment operation results.

B. Tests and Inspections:

1. Perform installation and two startup checks according to manufacturer's written instructions. First start-up check shall be to commission and perform factory start-up check.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operation test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

5. Check and adjust initial operation set points and high and low-limit safety set points of fuel supply, water level and water temperature.
6. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. 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.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate and maintain boilers. Refer to Division 01 Section “Demonstration and Training.”.

3.4 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

C. Contractor shall coordinate that initial chemical water treatment is introduced into the boiler and associated equipment (when the system undergoes the initial water fill sequence) to avoid equipment exposure to untreated water (other than water utilized during flushing cycles).

3.5 SCHEDULES

A. Refer to Plan Sheet Schedules.

END OF SECTION

SECTION 238103 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged rooftop air conditioning unit.
2. Roof curb.

B. Related Sections:

1. Section 230923 - Air Flow Measuring.
2. Section 230923 - Direct-Digital Control System for HVAC: Controls remote from unit.
3. Section 230993 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
4. Section 232113 - Hydronic Piping: Water and Drain piping connections.
5. Section 233300 - Air Duct Accessories: Flexible connections.
6. Section 260503 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
2. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
3. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International:

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 54 - National Fuel Gas Code.

1.3 DEFINITIONS

A. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity (in BTUH) to total rate of electric input (in W/HR) under designated operating conditions with equipment capacity of 65,000 BTUH or greater and three phase electrical power.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:

1. Cooling and heating capacities.
2. Dimensions.
3. Weights.
4. Optional accessories.
5. Rough-in connections and connection requirements.
6. Duct connections.
7. Electrical requirements with electrical characteristics and connection requirements.
8. Controls and coordination with the Controls Contractor.
9. Accessories and relays.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer’s Field Reports: Submit start-up report for each unit.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 340/360.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Performance Requirements: Conform to minimum efficiency rating prescribed by ASHRAE 90.1 when tested in accordance with ARI 340/360 for EER rated equipment.

E. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept units on site. Inspect for damage.

C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.8 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.9 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Maintenance service.

1.10 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of filters for each unit.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for compressors.

PART 2 PRODUCTS

2.1 ROOFTOP AIR CONDITIONING UNITS

A. Manufacturers.

1. Aaon.
2. Johnson Controls, Inc.
3. Daikin.
4. Trane.
5. Greenheck.
6. Approved equal manufacturer prior to bidding.

2.2 SUMMARY

A. The contractor shall furnish and install package rooftop unit(s) capable of heating, cooling, filtration, economizer and providing room neutral dehumidified air as shown and scheduled on

the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled. The units shall be configured for VAV operation or single-zone variable-volume operation. Refer to equipment schedule for detailed information.

2.3 GENERAL UNIT DESCRIPTION

A. Unit(s) shall consist of insulated weather-tight casing with the following:

1. Supply and exhaust fans (as scheduled) and motors with factory-supplied variable-frequency drives or ECM motors with control panel.
2. Hot water heating coil.
3. Scroll compressors, with inverter-type motor where indicated.
4. DX cooling coil.
5. Air-cooled condenser coils with condenser fans.
6. Mixed air filters.
7. Factory-supplied airflow-measuring stations. Refer to control drawings and Section 23 0923 for OAFM station details.
8. DDC-Ready control configuration.

B. Cooling capacity ratings shall be based on ARI Standards.

C. Unit shall be 100 percent factory run tested and fully charged with R-454B refrigerant.

D. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

E. Units shall be manufactured as dedicated down-flow supply and exhaust air.

F. Wiring internal to the unit shall be colored and numbered for identification.

2.4 UNIT CASING

A. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with hinged access panels. Structural members shall be 16 gauge with access doors and panels of minimum 20 gauge.

B. Units cabinet surface shall be tested 500 hours in salt spray test in compliance with ASTM B117.

C. Cabinet construction shall allow for all service/maintenance from one side of the unit.

D. Cabinet top cover shall be one piece construction or where seams exist, it shall be double hemmed and gasket sealed.

E. The base of the unit shall have provisions for forklift and crane lifting.

F. The entire cabinet shall be double-wall constructed with foam injection insulation to provide a minimum of R-8 value.

2.5 AIR FILTERS

A. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. Refer to Specification Section 23 4000 and plan schedule for 2" pre-filter and 4" final filter requirements.

2.6 FANS AND MOTORS

A. Provide evaporator supply fan and exhaust fan section with single width, AF plenum fan per plan schedule.

B. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

C. Provide centrifugal or propeller type exhaust fan(s) for powered relief per plan schedule.

D. Outdoor and indoor fan motors shall be permanently lubricated and have internal thermal overload protection.

E. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

F. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

G. Refer to schedule for fan drive with ECM and VFD used for fan speed modulation.

2.7 HOT WATER HEATING COIL

A. Constructed at seamless copper tube mechanically expanded into aluminum fins.

B. See Schedule for rows, fins, and capacities.

C. Furnish coil with vents and drains factory installed.

D. Factory leak tested underwater.

E. Control Valve: Field installed. Refer to Sequence of Operations and Coil Details on Plan for type.

2.8 EVAPORATOR COIL

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

B. Provide an independent expansion device for each refrigeration circuit. Factory pressure test at 450 psig and leak tested at 200 psig.

C. The quantity of rows shall be three (3) or greater and as required to meet discharge criteria. The use of less rows must be pre-approved by the Engineer before shop drawing submittal.

D. Evaporator coils for multi-compressor, multi-circuit units shall have multi-circuited inter-twined face arrangement.

E. Drain pan shall be constructed of either PVC or stainless steel and shall be pitched and shall have a break to direct condensate to drain outlet.

2.9 CONDENSER SECTION

A. Provide internally finned 3/8" seamless copper tube mechanically bonded to aluminum fins. Factory pressure tested to 450 psig.

B. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather-tight casing.

C. Provide unit with hail guards to protect the coils.

2.10 DRAINS

A. The manufacturer shall provide 1" capped drain pan connections on the side of the unit for complete draining ability of the base pan for the following sections:

1. Outside air plenums.
2. Sections upstream and downstream of coils.

B. BAS Contractor shall provide a condensate level float switch to shut the unit down if the drain pan outlet gets plugged and drain pan is nearing over-flow condition.

2.11 REFRIGERATION SYSTEM

A. Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. The lead compressor on each refrigeration circuit shall be a modulating invertor rated scroll type.

B. Units shall provide scheduled cooling capabilities down to 50°F ambient as standard.

C. Provide with thermostatic temperature control in the compressor windings, to protect against excessive conditions.

D. Refer to plan schedule for quantity of compressors, staging and modulation requirements.

E. Units shall be configured with fixed-speed and modulating scroll compressors as scheduled. Compressors shall be variable-speed design. Unit shall have one or two refrigeration circuits (as scheduled) factory-supplied and completely piped with liquid line filter drier, suction, and liquid Schraeder valves. The lead circuit shall have a variable-capacity compressor. Refer to equipment schedule for more detailed information.

F. Refer to plan schedule for notes relating to number of compressors, number of stages, number of circuits and staged or inverter rated compressors. If modulating compressors are scheduled the use of staged compressors is not allowed.

G. Provide refrigeration only controls. BAS system shall provide analog cooling demand signal to the packaged refrigeration controller which stages and modulates the compressor operation.

2.12 DEHUMIDIFICATION SYSTEM (RTU-5, 6, 7, 8 ONLY)

A. Units shall incorporate factory mounted hot-gas reheat systems capable of reheating cooled air to space neutral (73°-77°F) temperatures. Unit shall incorporate a refrigerant diverting valve capable of diverting refrigerant to reheat circuit or condensing circuit as necessary. Units that are not capable of providing room neutral air as described above are not acceptable.

B. Unit shall divert refrigerant as necessary to hot gas reheat coil in the supply airstream when in dehumidification mode to reheat dehumidified supply air to space neutral temperature.

C. Unit shall use refrigerant sub-cooling circuit in condensing section as necessary to maintain dehumidification capacity, supply air temperature, and unit efficiency.

2.13 OUTDOOR AIR SECTION

A. Dampers and actuators for outside air and return air shall be provided and wired to a terminal strip for BAS connection and control.

B. Gaskets: Provide tight fitting dampers with edge gaskets, maximum leakage 5 percent at 2 inches pressure differential.

C. Damper Actuator: 24-volt with gear train sealed in oil with spring return.

D. BAS Contractor shall modulate dampers as required to maintain minimum outside air positioning or economizer operation per Sequence of Operations.

2.14 ROOF CURBS

A. Roof curbs shall be 24” tall and constructed of galvanized steel. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit.

B. Unit shall be mounted on a factory-furnished acoustical style solid bottom insulated (R-12) roof curb with insulation on all four exterior surfaces and the floor. Provide a wood nailer strip for unit fastening.

2.15 AUTOMATION CONTROL INTERFACE

A. The electronic control systems for the rooftop units shall be configured as “DDC Ready” to allow for building automation system (BAS) control of the units. The unit shall be provided pre-wired to allow for BAS control of the following unit functions:

1. Return air damper control.
2. Outside air damper control.

3. DX cooling control. BAS enables the cooling or dehumidification and provide a cooling demand signal and integrated factory controls operate all modulating and fixed-speed compressor operation.
4. Supply and return/exhaust start/stop and speed control. BAS shall control fan speed as required via factory-supplied variable frequency drives (VFD's) or ECM.
5. Hot-gas reheat dehumidification control. BAS enables the dehumidification function, but integrated factory controls operate all functions necessary to run the hot-gas reheat system.

B. Damper actuators shall be provided within the packaged unit and shall be wired back to the terminal strip for use by the BAS contractor.

C. Supply fans shall be varied by a VFD or ECM provided within the unit and a duct-mounted S.P. sensor that shall be provided and installed by the BAS contractor.

D. Exhaust fan(s) shall be varied by a VFD or ECM provided within the unit. Pressure sensor and control provided by BAS Contractor.

E. The intent of the design is for control via the BAS hard-wired points. If the HVAC unit manufacturer cannot comply with the "DDC-Ready" requirement for hard-wired control by BAS, a factory-installed BACnet controller can be utilized provided the available read/write control points can accomplish the engineers control sequences as written.

F. Unit manufacturer shall review the Sequence of Operations in detail before bidding the project. If their factory controller cannot provide for implementation of the written control sequences, the equipment will be considered non-compliant and shall be submitted.

G. Contractor shall include the BAS Contractor in original submittal chain for their controls review. Manufacturer shall further coordinate the control requirements with the successful BAS contractor bidder before fabrication of the units begin. BAS contractor must confirm total compatibility by review of the shop drawings before release of the order.

H. Unit manufacturer shall have a controls expert available to the BAS contractor for trouble shooting any point conflicts. If the conflict cannot be resolved by an off-site computer correction, phone or email, onsite visit(s) must be provided until all point conflicts are resolved.

2.16 ELECTRICAL

A. Each unit shall have a 115-volt control circuit transformer supply air firestat, control circuit fuse and a single point power connection with circuit breaker. Division 26 will provide a 115-volt ground fault receptacle on a separate circuit.

B. The supply and exhaust fan, compressor and condenser fan motor branch circuits shall all be individually fused. Contactors and inherent thermal overload protection shall be furnished for each compressor and condenser fan motor. The supply and exhaust fan motors shall have contactors and external overload protection. Main control panel shall be of weatherproof construction with a dead-front cover over the main power circuit controls.

C. The electrical panel circuit breaker shall be acceptable as over-current protection. If the unit being provided is not rated for “Circuit Breaker” protection and requires a fused disconnect, then the manufacturer shall provide the fused disconnect and fuses at no additional cost.

D. Provide units with kAIC SCCR rating per plan schedule.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 PREPARATION

A. Furnish roof curbs to the General Trades Contractor for their installation.

3.3 INSTALLATION

A. Roof Curb:

1. Assemble roof curb.
2. Install roof curb on blocking such that the bottom edge of the curb is a maximum of 3" below the finished roof surface. The curb shall not be mounted directly on the roof decking.
3. Coordinate curb installation and flashing with the General Trades Contractor.
4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
5. Install gasket material between unit base and roof curb.
6. All openings for duct, piping and conduits shall be sealed with an acoustical type sealant.

    a. Design standard is C.R.L. Norseal #V730 with ¼” thickness by 1-1/2” width.

7. In addition, beneath the units and inside the curb, install a sound isolation barrier of 5/8” gypsum board or cement board, sealed with acoustical tape to the curb structure, pipe and duct.
8. For units set on new structural steel platform, coordinate spacing of beams such that unit rests directly on beams while spacing for piping, conduits and ductwork is accounted for.
9. Connect units to supply and return ductwork with flexible connections. Refer to Section 233300.

B. Install galvanized condensate piping with trap and route from drain pan to splash block on roof. Refer to Section 232113.

C. Install components furnished loose for field mounting.

D. Install electrical devices furnished loose for field mounting.

E. Install control wiring between unit and field installed accessories.

F. Properly dispose of shipping panels removed from unit during installation of economizer and dampers.

3.4 INSTALLATION - HOT WATER HEATING COIL

A. Make connections to coils with unions or flanges. Verify that unit has adequate chase and piping space for all fittings, insulation and maintenance access.

B. Connect water supply to leaving airside of coil (counter flow arrangement).

C. Locate water supply at bottom of supply header and return water connection at top.

D. Install water coils to allow draining and install drain connection at low points.

E. Install the following piping accessories on hot water piping connections. Refer to Section 232113.

1. On supply:

a. Thermometer well and thermometer.
b. Well for control system temperature sensor.
c. Shutoff valve.
d. Strainer.
e. Control valve.
f. Pressure gauge.

2. On return:

a. Thermometer well and thermometer.
b. Well for control system temperature sensor.
c. Pressure gauge.
d. Shutoff valve.
e. Flow control valve.

F. Install valves and piping specialties in accordance with details as indicated on Drawings.

G. Install manual air vents at high points complete with shutoff valve. Refer to Section 232113.

H. Install hot water piping accessories within unit casing or below roof as shown on Plans.

3.5 CONTROLS

A. The Mechanical Contractor and this packaged RTU supplier shall coordinate this equipment's shop drawing with BAS Contractors shop drawing to clearly define how the controls specifications and Sequence of Operations requirements are achieved.

B. This RTU equipment supplier and the BAS sub-contractor must both acknowledge that this coordination is complete before this RTU equipment can be released for production.

3.6 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.

B. Furnish initial start-up and shutdown during first year of operation.

3.7 CLEANING AND FILTERS

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. If use is allowed during construction period, install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

D. After substantial completion inspection and just before turning this equipment over to the Owner, a new set of filters shall be installed and an extra set, for the first filter change by the Owner, shall be stored in the Mechanical Room or closest Custodian space. The filters shall be labeled with the equipment served number for which they are intended.

3.8 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

3.9 SCHEDULES

A. Refer to Plan Sheet Schedule.

END OF SECTION

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SECTION 238200 - TERMINAL HEATING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Finned Tube Radiation.
2. Propeller Unit Heaters.
3. Cabinet Unit Heaters.

B. Related Sections:

1. Section 230700 - HVAC Insulation: Execution requirements for insulation specified by this section.
2. Section 232113 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, and drain piping to units specified by this section.
3. Section 232116 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
4. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Institute of Boiler and Radiator Manufacturers:

1. IBR - Ratings for Heat Output at Terminal Devices.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data and parts listings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one extra sets of filters.

PART 2 PRODUCTS

2.1 FINNED TUBE RADIATION

A. Manufacturers:

1. Sterling.
2. Vulcan Radiator.
3. Rittling, Inc.
4. Airedale.
5. Sigma.
6. Approved equal manufacturer prior to bidding. Refer to Division 01.

B. Heating Elements: Seamless copper tubing, mechanically expanded into evenly spaced aluminum fins sized suitable for soldered fittings. Refer to Plan Sheet Schedule for tube and

fin sizes. Fin size, fin quantity and tubing size that is scheduled will be the only type accepted in Shop Drawings. No variations allowed without prior approval of the Engineer.

C. Element Hangers: Quiet operating bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

D. Enclosures: Easily jointed components for wall to wall installation. Support rigidly, on wall or floor mounted brackets. Refer to Plan Sheet Schedule for sheet metal gauge.

E. Access Doors: For otherwise inaccessible valves, furnish factory-made permanently hinged access doors, 6 x 7 inch minimum size, integral with cabinet.

F. Capacity: IBR rating as scheduled, based on 65°F entering air temperature, 150 °F average water temperature.

G. Finish: Factory applied baked enamel of color as selected by Architect/Owner.

2.2 MANUFACTURERS - PROPELLER AND CABINET UNIT HEATERS

A. Sterling.

B. Vulcan Radiator Corp.

C. Airtherm.

D. McQuay.

E. Dunham Bush.

F. Modine Manufacturing Co.

G. Rittling.

H. Airedale.

I. Sigma.

J. Approved equal manufacturer prior to bidding. Refer to Division 01.

2.3 HORIZONTAL OR VERTICAL PROPELLER UNIT HEATERS

A. Coils: Seamless copper tubing, 0.025 inch minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

B. Casing: Minimum 20 gauge steel with threaded pipe connections for hanger rods.

C. Finish: Factory apply baked enamel finish.

D. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

E. Air Outlet: Adjustable pattern diffuser on projection models and four way louvers on horizontal throw models (double deflection).

F. Motor shall be totally enclosed fan cooled, resilient mounted. Built in thermal overload protection and permanently lubricated sleeve bearings.

G. Control: Thermostat will cycle the fan motor. Disconnect switch by Electrical Contractor.

H. Capacity: Based on 60°F entering air temperature, 160 °F water temperature and a 20° temperature drop. one psig steam.

2.4 CABINET UNIT HEATERS

A. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, rated at 150 pounds of pressure.

B. Cabinet: 18 gauge (16 gauge front panel) steel with exposed corners and edges rounded, easily removed panels. Insulation on interior panel with end pockets on both sides of coil. Mounting of units shall be provided by use of an adjustable trim flange. Use of projection panel must have written approval before bid due to lack of flexibility in adjusting recess depth.

C. Finish: Factory applied baked enamel in a color as selected by Architect from manufacturer's standard color chart.

D. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

E. Motor: Motors shall be permanent split capacitor.

F. Control: Multiple speed and off selector switch, factory mounted and wired, located in cabinet.

G. Provide access doors on both ends as required for coil connection and electrical. Access doors shall have key-lock or tamper-proof screws.

H. Filter: Easily removed throw-away type, located to filter air before coil or motor.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

A. Make connections to units with unions and flanges.

B. On water coils, install shut-off valve on supply piping and lockshield balancing valve on return piping. Locate water supply at bottom of supply header and return water connection at top. Install manual air vents at high points complete with stop valve. Install water coils to be drainable and install drain connection at low points. Refer to Section 232113.

C. On water glycol heating coils, connect water supply piping to leaving airside of coil (counter flow arrangement). Refer to Section 232113.

D. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

E. Protection: Install finished cabinet units with protective covers during remainder of construction.

F. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Install wall angles where units butt against walls.

G. Propeller Unit Heaters: Support from building structure, independent of piping. Pipe hangers anchored to building with no unit weight supported by the piping. Mount unit as high as possible to maintain greatest headroom unless otherwise indicated.

H. Cabinet Unit Heaters: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units. In remodeling projects, verify existing wall opening dimensions and provide a unit that is of proper size so the adjustable flange covers openings on all four (4) sides. If the existing unit is too tall for standard available flange, the bottom portion of the opening shall be filled with a matching sheet metal in-fill panel.

I. Hydronic Units: Install with shut-off valve on supply piping and lockshield balancing valve on return piping. Where not accessible, extend vent to exterior surface of cabinet for servicing. For cabinet unit heaters and unit heaters, install manual air vents with stop valve. Refer to Section 23 21 13.

3.3 CLEANING AND FILTERS

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

D. After substantial completion inspection and just before turning this equipment over to the owner, a new set of filters shall be installed and an extra set, for the filter change by the owner, shall be stored in the Mechanical Rom or closest custodial space. The filters shall be labeled with the equipment served number they are intended for.

3.4 SCHEDULES

A. Refer to Plan Sheet Schedules.

END OF SECTION

SECTION 260010 - GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 GENERAL

1.1 GENERAL

A. The work shall consist of the furnishing of all labor, materials, services, and equipment necessary for, and incidental to the electrical work called for on the drawings and specifications.

B. The work shall also include the completion of details of electrical work not mentioned or shown, which are necessary for the successful operation of the electrical systems described on the drawings and as required by the specifications.

C. The only electrical work not included shall be those items explicitly indicated to be excluded.

D. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations from the contract documents.

E. The final installed electrical systems shall be complete and in all respects ready for use, tested as indicated and/or required with test reports, prior to the final site observation and/or the Owner's acceptance. The work of these documents shall consist of furnishing all labor, materials, services, and equipment necessary for and incidental to the electrical work called for on the drawings or specifications.

F. The Contractor is responsible for review of all drawings, including but not limited to architectural, mechanical, structural, civil and landscape for portions of their work to be included or coordinated. No extra credits will be allowed due to the Contractor’s failure to review and coordinate with all other disciplines.

G. Contractor shall visit the site and become familiar with on-site conditions before submitting their bid. Failure to visit the site will in no way relieve the contractor the necessity of performing work and any work required to complete the work intended by the drawings and specifications, which should be determined by the site visit.

H. The drawings and specifications are intended to supplement each other, such that information contained in either shall be executed in the same manner.

I. If a question exists regarding the exact intention of the documents, instructions shall be obtained from the Architect/Engineer before proceeding. If instructions cannot be obtained due to time or communication limitations, the greater quantity, superior quality, or condition most favorable to the Owner shall be assumed.

J. The drawings are in general diagrammatic and not intended to show exact locations. The drawings are not intended to be scaled for rough-in dimensions or exact locations. Architectural, mechanical, structural, fixture, landscape drawings, etc. shall be consulted for exact locations if required. Only critical dimensions will be provided.

K. Branch circuit wiring may not be shown on the drawings, but are designated by the indication of panel and circuit numbers, respectively. Panel designations may also be indicated by

general plan notes on each drawing. Panel and circuit designations are shown adjacent to a device for lighting and receptacles. Motor branch circuiting is indicated on the motor and equipment schedule, while other circuiting requirements shall be as indicated in notes, schedules, etc.

L. Locations and routing of all conduits, wiring, cables, homeruns, etc. shall be verified and coordinated by the Electrical Contractor prior to installation. If conflicts arise, or it is not clear as to the exact intent, the Contractor shall notify the Engineer for clarification. The complete installation shall be done in a neat and orderly fashion.

1.2 CODES & STANDARDS

A. The complete installation shall conform to all of the requirements and recommendations of the currently recognized versions of the following codes and standards.

1. National Electrical Code - NFPA-70.
2. National Fire Alarm Code - NFPA-72.
3. State, city and local electrical laws and ordinances.
4. Institute of Electrical and Electronic Engineers.
5. National Board of Fire Underwriters.
6. National Electrical Manufacturers Association.
7. Underwriters' Laboratories, Inc.
8. NECA Standard of Installation.
9. ADA Guidelines.
10. Minnesota Energy Code.

B. The codes and standards are minimum requirements with respect to the installation as shown and specified, and are intended to comply with these requirements. Where conflicts exist, the greater quantity, superior quality or condition most favorable to the Owner shall be assumed.

1.3 RELATED DOCUMENTS

A. The General Conditions of the Contract for Construction, Supplementary Conditions and the General Requirements of Division 1 are hereby made a part of Division 26.

B. The sections contained in Division 26 may conflict with the conditions of contract of the General Requirements. The statement requiring the greater quantity, superior quality, or condition most favorable to the Owner shall take precedence.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

D. The sections contained in Division 26 may conflict with Divisions 0-23. The statement requiring the greater quantity, superior quality, or condition most favorable to the Owner shall take precedence.

E. Division 26 work shall include all electrical work referenced in Divisions 0-23 unless explicitly indicated otherwise.

F. Division 26 shall provide all 120 volt AC power connections as required to all doors with access control equipment. Coordinate requirements with access control suppliers, Division 08, Division 28 and Architect's hardware schedules. Provide fire alarm system connections as indicated in schedules.

G. Provide for equipment operation instruction and training to the Owner's personnel. Refer to Division 01 Section "Demonstration and Training" and specific Division 26 Sections as applicable.

H. Where Division 26 is referenced within the General Provisions, it shall also apply to Division 27.

1.4 SPECIAL CHARGES

A. All fees, permits, and licenses required for the electrical work are to be included in the contract.

B. If more than two final site inspections are required by the Engineer, the Contractor will be billed at an hourly rate for the time associated with the additional site visits.

1.5 SUBMITTALS

A. General:

1. All requests for information, clarification, etc., shall be submitted in writing to the Engineer with a copy to the Owner/Architect.
2. All shop drawings and operating manuals shall be submitted to the Engineer with transmittal copies to the Owner/Architect.

B. Shop Drawings.

1. Refer to Section 01 3300 "Submittal Procedures" for requirements pertaining to the electronic submittal procedures of shop drawings for this project.
2. Shop drawings shall be submitted on Division 26 items as specified in individual sections.
3. Shop drawings shall be submitted on Division 26 items, individually, by specific specification section number.
4. Shop drawings shall be stamped approved by the Contractor prior to submittal.
5. Shop drawings shall include detailed product information with catalog numbers, features, dimensions, wiring diagrams, and any other critical information clearly highlighted. The related specification sections may require additional information.
6. Shop drawings must be submitted in a format to allow easy identification of the exact item that is to be furnished, with all optional features or components clearly identified.
7. Shop drawings not properly submitted will be returned and not reviewed.

C. Operating Manuals.

1. Comply with requirements of Section 01 7823, "Operation and Maintenance Data".

2. Upon completion of the project, two operating manuals shall be submitted to the Engineer with transmittal copies to the Owner and Architect. Manuals will be forwarded to the Owner upon review completion.
3. Operating manuals shall include information on all electrical equipment requiring shop drawings.
4. Manuals shall include, but not be limited to; one set each of shop drawings, manufacturers' maintenance and operating manuals, replacement parts lists, and local suppliers and service organizations.
5. All information shall be bound in hard covered three ring binders individually labeled and indexed.

D. Record Drawings.

1. Comply with requirements of Section 01 7829, “Project Record Drawings”.
2. The Electrical Contractor shall provide record drawings reflecting all additions and/or modifications to the system(s) shown and required. These shall be submitted to the Engineer for approval upon completion of the project. Reproducible copies of the base contract documents shall be provided to the contractor upon request for this purpose.

E. Programming Documentation, Software.

1. Operation and Maintenance Data: For security monitoring and control equipment components to include in emergency, operation, and maintenance manuals.
2. Program documentation, software licenses, and backup copies of software used on Project.

F. Other Information Submittals.

1. Examination reports documenting inspections of substrates, areas, and conditions.

1.6 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Conduct all coordination, scheduling, work requests, and negotiations with the Utility regard to service connections or interruptions required for the completion of this project.

D. Coordinate electrical service connections to components furnished by utility companies (telephone, power, cable television, etc.).

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of Authorities Having Jurisdiction (AHJ) and of Utility Company providing electrical power and other services.

E. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager, and Owner no fewer than two weeks in advance of proposed interruption of service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without written permission from Architect, Construction Manager and Owner.
4. Comply with NFPA 70E.

F. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors".

G. Coordinate the height of receptacles and electrical devices as not to interfere with fin-tube radiation and architectural millwork. If a conflict is identified notify the engineer to define the new height of the device.

1.7 SYMBOLS AND ABBREVIATIONS

A. Refer to symbols and abbreviations on drawings. Other symbols are in common usage, but if uncertainty exists regarding any plan symbols or abbreviations, it shall be brought to the attention of the Engineer, and he shall clarify same by addendum.

B. Where the phrase "Provide -----" occurs; "provide" shall be construed to mean the same as "furnish and install -----".

1.8 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 and as follows. Prepare ¼”=1’-0”, or larger, detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components including but not limited to lighting components, power components, fire alarm devices, communications devices, fire protection components, electrical components, structural components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of work, including, but not necessarily limited to the following:

1. Indicate the proposed locations equipment and materials. Include the following:

a. Conduit / Raceway routing.
b. Component placement on walls.

c. Working Clearances.
d. Access Points / Access Panel Requirements.

2. Indicate scheduling, sequencing, movement and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations and details to indicate penetrations in floors, walls and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling mounted equipment.

B. Each trade shall review these drawings for coordination with their respective trade work.

C. Following the review of these drawings by the trades, an on-site coordination meeting shall be convened, and attended by all the above Contractors, the General Contractor, and the Mechanical and Electrical Design Engineers, and Architect for the purpose of review and coordination. This meeting allows the opportunity for all Contractors to resolve coordination issues prior to the fabrication and installation of material. This coordination meeting shall take place before any material is fabricated or ordered.

D. No additional cost to the project will be accepted for any coordination related items if this process is not adhered to.

1.9 CAD DRAWING FILES

A. All Division 26 electronic CAD drawing files provided by the Architect/Engineer for this project are for use solely with respect to this project. Contractor may request copies of the Division 26 CAD drawing files for the preparation of Shop Drawings. However, CAD drawing files shall not be used on other projects, for additions to this project, or for completion of this project by others. Any intentional or unintentional revisions, additions, or deletions to these Division 26 CAD drawing files shall be made at the full risk of the person(s) making such revisions, additions, or deletions, and such person(s) shall hold harmless and indemnify Architect/Engineer of any and all responsibilities and liabilities.

B. CAD diskettes are not to be construed as updated As-Built Construction Documents. The drawing files reflect only bidding documentation of original Construction Drawings. Addenda or written changes occurring during the construction process will not be incorporated into the Division 26 CAD drawing files.

C. Cost for Division 26 CAD drawing files, provided in AutoCAD format (other formats will be available only by special arrangement with Edi-dolejs Consulting Engineers), will be $100 per drawing sheet, payable directly to Edi-dolejs Consulting Engineers. CAD diskettes may be obtained on a COD basis at the office of Edi-dolejs Consulting Engineers.

D. Procedure for acquiring CAD files shall be as follows:

1. Contractor shall make a request to Edi-dolejs Consulting Engineers in writing, including a list of the files desired.

a. Engineer will send the contractor an invoice and “Document Release and Indemnity Agreement”.

b. Contractor shall sign this agreement and send a check for the amount to the Engineer.
c. Upon receipt of these items, Engineer will send the CAD files to contractor. Files will be sent electronically.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Lay-out and coordinate all work well enough in advance to avoid conflicts or interferences with other work in progress. In case of interference, the electrical layout may be altered to suit the conditions, prior to the installation of any work, and without additional cost. Conflicts arising from lack of coordination shall be this contractor's responsibility.

B. Work lines and established heights shall be in strict accordance with other related drawings and specifications. Verify all dimensions shown and establish all elevations and detailed dimension.

C. Perform all work in conformity with the construction called for by other trades and afford reasonable opportunity for the execution of their work. Properly connect and coordinate all work with the work of other trades at such time, and in such a manner as not to delay or interfere with their work.

D. Promptly report to the Architect/Engineer any delay or difficulties encountered which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others. Failure to so report shall constitute an acceptance of work of other trades as being fit and proper for the execution of this work.

E. Plan all work so that it proceeds with a minimum of interference with other trades. Inform all parties concerned of openings required for equipment or conduit for electrical work, and provide all special frames, sleeves and anchor bolts as required.

3.2 WORKMANSHIP

A. Only quality workmanship will be accepted. All parts of the electrical systems such as conduits, cables, plates, boxes, lighting assemblies, etc., shall be square and true with the building or site geometry, and shall be neat and orderly in appearance.

3.3 SCHEDULE

A. Schedule all work such that the progress of the electrical work will conform to the progress of the other trades. Complete the entire installation as soon as the conditions of the project will permit. Any cost resulting from defective or ill-timed work performed under this section shall be borne by this Contractor.

B. Contractor shall prepare an accurate schedule for every construction meeting.

3.4 ALTERNATES

A. As indicated in the individual specification sections, add or deduct alternate prices may be requested for various items.

B. Alternate prices shall be included (where provisions exist) on the proposal form, or the Contractor shall attach to the proposal form their alternate prices, in letter form.

C. Failure to submit an alternate price may void a proposal.

D. Requested alternate prices may be used in the Contractor selection.

3.5 GUARANTEE

A. Guarantee all materials and equipment installed under this subcontract against defects in workmanship and materials for a period of twelve (12) months after final acceptance of the work by the Owner. Repair and/or replace any materials or equipment developing such defects within that time promptly, upon due notice given by the Owner, at no addition expense to the Owner.

B. All equipment bearing a manufacturer's guarantee shall be construed as an extended guarantee to the Owner by the Manufacturer. Any such equipment that proves to be defective in materials or workmanship within the guarantee period is to be replaced by the Subcontractor in accordance with the manufacturer's guarantee, at no additional expense to the Owner.

END OF SECTION

SECTION 260011 - ELECTRICAL ALTERNATES

PART 1 GENERAL

1.1 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for work defined that may be added or deducted from the Base Bid amount if the 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. The cost or credit for each alternate is the net addition or deduction from the Contract Sum to incorporate alternate into the work. No other adjustments are made to the contract sum.

1.2 PROCEDURES

A. Coordination: Modify 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 complete installation whether or not indicated as part of alternate.
2. Execute accepted alternate(s) under the same conditions as other work for the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Provide cost of electrical work associated with each alternate.

3.2 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Remove suspension volleyball net in Gym.

B. Alternate No. 2 - Remove wrestling mat hoist system in Multi-purpose Room.

C. Alternate No. 3 - Setup west interior elevation scoreboards as alternates.

END OF SECTION

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SECTION 260090 - ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all material, labor, services, equipment necessary to complete all demolition activities and removal of electrical work indicated on the drawings or required to fulfill the intent of the construction.

B. The demolition drawings show intent and do not necessarily indicate the level of work to or existing conditions. The contractor shall verify the details and examine the building conditions prior to bidding the project. Details that are not clear shall be referred to the architect and engineer for clarification prior to bidding.

C. It is the intent of this specification and accompanying drawings to describe and indicate the demolition work to be performed. It is not the intent that the specifications and drawings describe and indicate every piece of equipment required to be removed for where items are intended to be removed or as required for the satisfactory completion of the project or is considered to be the accepted practice of the trade, they shall be considered to be specified and indicated.

D. Cooperation with Contractors under separate contracts is required, and the work described herein and shown on the drawings shall be coordinated as required to fulfil the intent of the contract.

E. Related Sections include the following:

1. Division 260010 Section "General Provisions for Electrical Work" for general conditions.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. The Contractor shall provide all equipment and materials necessary for the removal of relocation of electrical equipment.

PART 3 EXECUTION

3.1 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.2 GENERAL

A. Provide temporary facilities and connections to maintain the operation of the facility by the owner. Coordinate all scheduled outages with the owner to minimize interruptions to the facility and smoothly transition to the new services.

B. Demolition work shall be performed in such a manner as to avoid hazards to persons and property. Work shall be performed is strict accordance with all Municipal, State and Federal Rules, Regulations, Codes and Laws which govern and apply to this work.

C. Phase all demolition activities to coordinate with the general construction and other trades schedules to minimize the downtime the Owner will experience.

D. Where electrical equipment is indicated to be removed or relocated, the work shall include the complete disconnection from its source, dismantling as necessary, and removal or installation of all conduit, wires, cables, etc. Unless noted otherwise, wires shall be removed from conduits back to the last utilization device or to the panelboard. No wiring shall be removed that prevents operation of other equipment not scheduled or indicated to be removed.

E. All electrical work in adjoining areas which is indicated on the drawings to continue to function but is affected by demolition work shall be reconnected and restored to present function as part of the electrical system of the building.

F. No portion of the electrical or communication systems may be abandoned in place. Remove all electrical material to a previous point of usage.

G. Cut back to floor, wall, or ceiling and plug ends of concealed conduits made obsolete by alterations to permit refinishing surfaces.

H. Remove exposed conduits, wireways, outlet boxes, hangers and devices made obsolete by this work unless designated specifically to remain.

I. Provide blank plates on all unused outlet boxes.

J. The existing distribution system shall be modified as indicated on the plans and specified herein. The revised system shall be complete and continuous with all superfluous equipment and connections which are not maintained to be removed.

K. Equipment, panelboards, and connections that are not intended to be demolished shall be maintained. Feeders and connections shall be protected and remain in use throughout the construction process.

L. Electrical circuit continuity shall be maintained where a device is removed from the circuit. Retrofit the circuit with conductors and raceways as required maintaining the connection to all devices that remain.

M. Lighting fixtures located in areas where ceilings or walls are to be replaced, shall be taken down, cleaned, and reinstalled in the new ceiling or wall. If conduit and wiring serving these fixtures must be removed to permit demolition work, new conduit and conductors shall be installed to provide existing circuit continuity.

N. Conduit shall be concealed within the existing building construction wherever possible, except where otherwise noted on the drawings.

O. Whenever electrical materials have been removed from surfaces of the building or structure, those surfaces shall be patched and repaired.

P. All raceways which become exposed beyond finished surfaces because of the alteration work shall be removed and rerouted behind finished surfaces.

Q. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

R. Existing circuits to be extended beyond the existing wall, ceiling, or floor to be removed shall be replaced with new conduits and conductors as required. Reroute the existing circuit or serve the remaining devices from another electrical source to maintain the circuit and device functionality.

S. Alarm and emergency systems are to be interrupted only with written consent of the Owner.

T. The Electrical Contractor is to reconnect any existing circuits interrupted by demolition as required to maintain power, control and/or communications.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Dispose of all equipment (fluorescent lamps, ballasts, etc.) in accordance with all Federal, State, and local laws. All fees for disposal shall be borne by the electrical Contractor.

B. The Contractor shall remove all demolished equipment from the site and pay for all disposal costs with the Owner having the option to retain any removed equipment.

C. All material and debris resulting from demolition activities shall be transported and disposed of in a legal fashion. The removal of fluorescent lamps, ballasts and other hazardous materials shall comply with all environmental laws.

D. Materials not noted to be reused or salvaged shall be removed from the premises and legally disposed off-site. Contractor shall not salvage material for his own benefit without written approval from Owner.

3.4 SALVAGED MATERIALS

A. All equipment noted, specified or required to be removed during demolition shall remain on the site, unless otherwise noted. The Owner reserves all rights to claiming material removed during demolition. The Contractor is responsible to remove from the site all material not claimed by the Owner. In addition, the Contractor is responsible to delivery to the Owner's storage facilities, equipment claimed by the Owner.

B. All existing materials and equipment noted, specified, or required to be salvaged and which are not scheduled to be reused, shall be carefully removed and handled to minimize damage. The Contractor shall be moved or delivered where directed by the Owner.

C. All existing material to be reused shall be carefully removed and stored in a dry location to minimize damage.

3.5 CLEANING AND REPAIR

A. All existing equipment to be reused shall be thoroughly cleaned prior to re-installation.

B. Unless noted otherwise, existing interior and exterior fixtures that are to be reused shall be cleaned with appropriate cleaning solutions and materials, and lamps and ballasts replaced with new lamps and ballasts.

C. Do not remove existing panels and switchgear noted to be reused. Maintain in place or reconnect as shown on plans. Clean and provide visual inspection of all existing panels and switchgear to be reused. Provide written report of all findings to Owner.

D. Upon completion of demolition work, remove all tools, equipment, and demolished material from the site.

E. Demolition work performed in access of that required by the intended scope of the work shall be repaired and/or returned to its condition prior to the commencement of the demolition operation.

END OF SECTION

SECTION 260100 - CONSTRUCTION POWER AND LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide temporary electrical service, including power and lighting distribution system for the construction portion of the project.
2. All first time charges by the utility company for installation and removal of the temporary system shall be included in this contract.

1.2 RELATED WORK

A. All utility company charges for power consumed during the construction period shall be paid by others. The construction period shall be defined as lasting until the owner assumes control of the project.

B. The construction power system shall not be used for heating.

1.3 REGULATORY REQUIREMENTS

A. The components and installation of the temporary lighting and power systems shall be, as a minimum, in conformance with the National Electrical Code and OHSA requirements.

1.4 PROJECT CONDITIONS

A. Interruption of Existing 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 Owner no fewer than five working days in advance of proposed interruption of existing service.
2. Do not proceed with interruption of existing service without Owner's written permission.

1.5 COORDINATION

A. Coordinate utilities with local power company. Provide required connections per power company requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials for temporary services shall be of condition and quality to assure adequate operation and safety of use and shall have the listed approval of Underwriters Laboratories, Inc. where applicable.

2.2 ELECTRICAL SERVICE

A. Service shall be a 200 amp (minimum) single-phase service rated 120/240 volts. At the contractor's option, service may be provided at 120/208 volts, 3-phase, 4-wire.

B. Service size shall be increased from 200 amps as required by the equipment to be powered, and the scope of the project.

C. A temporary service shall be provided for each building of the project. At the contractor's option, one temporary service may be provided and extended as required, to feed additional buildings in the project which are under construction.

D. Service equipment shall be located at, or adjacent to the location of the permanent electrical service.

E. The permanent electrical service may be used for temporary power when energized.

F. Provide connection from utility service to temporary power system. Provide all wiring, hardware, and labor to complete the installation.

2.3 LIGHTING PROVISIONS

A. A temporary lighting system shall be provided which will provide illumination suitable for the tasks to be performed throughout the facility.

B. Maintain the lighting system with light bulbs, etc. throughout the construction process.

C. Temporary lighting shall be provided at not less than ½ Watt per square foot with no less than one light per room.

D. Provide temporary emergency exit signage and emergency egress lighting while building is occupied. This shall include temporary exits constructed by the general trades contractors.

2.4 POWER PROVISIONS

A. A temporary miscellaneous power system shall be provided which shall consist of 20 amp, 120 volt duplex receptacles located throughout the facility. Receptacles shall be located to allow the use of 50 foot extension cords to reach all areas of the building.

B. The service panel shall contain a sufficient number of various sizes and configurations of circuit breakers to allow temporary connection of other loads as required.

C. All temporary power receptacles must be GFI protected.

2.5 MISCELLANOUS POWER PROVISIONS

A. Connections for miscellaneous equipment such as welders, compressors, etc. shall not be included in this contract. Connection costs associated with this equipment shall be borne by the contractor requiring the connection.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall comply with Temporary Wiring methods of applicable codes and ordinances.

B. Grounding shall comply with applicable codes.

C. Completed portions of the permanent installation or materials for use in the permanent installation shall not be used in the temporary installation without permission of the engineer.

D. Open wiring methods may not be used in public areas of the construction area.

E. Wiring and methods utilized shall follow industry and code accepted practices with the methods and materials utilized following the strictest available safety standards.

F. The contractor shall be totally responsible for providing a safe and usable installation.

G. Periodic maintenance of the temporary power and lighting system shall be provided, including replacing lamps and repairing equipment as damage occurs.

3.2 REMOVAL OF TEMPORARY POWER AND LIGHT

A. The Electrical Contractor shall be responsible for the complete removal of the temporary Power and Lighting system by the time of Substantial Completion.

B. The Contractor shall be responsible for patching all penetrations, to a finish like the adjacent surface.

C. Cutting temporary wiring at wall will not be acceptable.

END OF SECTION

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SECTION 260400 - UNDERGROUND ELECTRICAL SERVICE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes underground electrical service requirements that will be installed to serve the facility.

B. Related Sections include the following:

1. Division 26 Section "26 0100" - Temporary Power and Light.
2. Division 26 Section "26 0519" - Low Voltage Power Conductors and Cables.
3. Division 26 Section "26 0526" - Grounding and Bonding.
4. Division 26 Section "26 0533" - Raceways & Boxes for Electrical Systems.
5. Division 26 Section "26 2413" - Switchboards.

1.2 SUBMITTALS

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

B. Product Data: For the following:

1. Connection /Meter Cabinet.

C. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

1. Wiring Diagrams: Power, signal, and control wiring.

1.3 PROJECT CONDITIONS

A. New Construction.

1.4 COORDINATION

A. Coordinate location of electrical service including transformer with the drawings, Engineer, Architect and Utility Company.

B. Coordinate exact dimensions and construction requirements of transformer pad with the local utility.

C. Coordinate location of the transformer and minimum clearance requirements with the local utility.

D. The service connections shall be installed in strict accordance with the rules of the power company.

PART 2 PRODUCTS

2.1 EQUIPMENT MOUNTING BACKBOARD

A. Provide an equipment mounting panel adjacent to the service entrance for mounting electrical equipment.

B. Equipment Mounting Backboard shall be a ¾" thick plywood board painted with fire retardant gray paint.

C. Backboard shall be of sufficient size to mount the electrical equipment.

2.2 METER CABINET

A. Provide a meter cabinet as required by the Power Company.

B. Meter cabinet shall be weatherproof / rustproof with lockable removable access cover.

C. Provide a raceway as required between the meter cabinet and transformer.

D. Provide raceways and connections from the meter cabinet to the switchboard serving the building.

E. Locate utility metering and current transformers in the cabinet. Coordinate with the utility.

PART 3 EXECUTION

3.1 INSTALLATION

A. The underground electrical service shall be installed from the local utility service to the building service entrance equipment. The equipment shall be provided and installed by the Power Company (Utility) or Electrical Contractor (Contractor) as scheduled below:

	Furnished By	Installed By
Site Restoration	Contractor	Contractor
Primary Service Trenching	Utility	Utility
Primary Electrical Cable	Utility	Utility
Primary Raceways	Utility	Utility
Transformer Pad	Contractor	Contractor
Grounding Grid @ Transformer	Contractor	Contractor
Pad Mounted Transformer	Utility	Utility
Primary Connections @ Transformer	Utility	Utility
Secondary Connections @ Transformer	Contractor	Contractor
Secondary Service Trenching	Contractor	Contractor
Secondary Electrical Conductors	Contractor	Contractor
Secondary Raceways	Contractor	Contractor
Electrical Meter(s)	Utility	Utility
Electrical Meter Socket	Contractor	Contractor
Metering C.T. Cabinet	Contractor	Contractor
Current Transformers (utility meter)	Utility	Contractor
Metering Conductor Raceway	Contractor	Contractor
Metering Conductors	Contractor	Contractor
Connection Cabinet	Contractor	Contractor
Raceway from CC to Transformer	Contractor	Contractor

B. Conduct all coordination, scheduling, work requests, and negotiations with the Utility regard to service connections required for the completion of this project.

1. Utility: Ottertail Power.
2. Contact: Travis Pullis.
3. Phone No. 1.320.305.0564.

3.2 SERVICE CHARGES

A. Fees and charges submitted by the Utility for the work associated with this project shall be borne by the owner.

B. Electrical contractor shall coordinate exact requirements with the utility. No extra charges will be allowed because of the failure of the contractor to contact the Utility and determine what will be required to complete the service installation.

C. Charges (the electric bill) for power consumed during the construction of this project will be borne by the Owner.

3.3 GROUNDING

A. Provide grounding as required by the Utility, National Electrical Code.

B. Ground equipment according to Division 26 0526 Section "Grounding and Bonding."

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area after construction vehicle traffic in immediate area is complete.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to "Cutting and Patching" Article in Section 017300 "Execution." Repair surface to match existing.

3.5 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of installed raceways until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

SECTION 260445 - ELECTRICAL CONNECTIONS TO EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Equipment connections for all systems served or specified under Divisions 0-28, including but not limited to:

1. Fans and similar equipment.
2. Fan Powered Heating Equipment.
3. Refrigeration and Compressor Equipment.
4. Packaged equipment.
5. Boilers.
6. Water Heaters.
7. Dampers.
8. Pumps.
9. Architectural equipment.
10. Cord connected equipment.

B. Providing all labor, materials, accessories, etc. as required for a complete installation.

C. Provide motor starters, receptacles, etc. of the appropriate NEMA size and configuration. For units not using NEMA ratings, use equivalent NEMA equipment.

1.2 WORK RELATED

A. Equipment and motor connections as required and indicated for motors and equipment provided under Divisions 0-23.

B. Related Sections include the following:

1. Division 26 Section "26 0526" for Grounding and Bonding.
2. Division 26 Section "26 2813" for Fuses.
3. Division 26 Section "26 2816" for Safety Switches.
4. Division 26 Section "26 2913" for Enclosed Controllers.
5. Division 23 Section "23 0933" for Variable Frequency Motor Controllers.
6. Division 26 Section "26 7111" for Fire Alarm System.

1.3 SUBMITTALS

A. Field quality-control test reports.

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. Comply with NFPA 70, "National Electrical Code."

1.5 COORDINATION

A. Coordinate size and location of concrete bases.

B. Coordinate size and location of concrete housekeeping pads.

C. Coordinate equipment connections with all trades.

PART 2 PRODUCTS

2.1 GENERAL

A. All equipment powered/connected under the electrical contract shall be provided with (as a minimum) a N.E.C. acceptable disconnect (safety) switch, motor starter (or VFD) and a power connection.

B. Conduit and wiring means and methods shall, as a minimum, comply with all other sections of these specifications.

C. All equipment to be controlled by temperature or other controlling systems shall be provided with a magnetic starter or other electrical/mechanical device to interface with the controlling system and the power wiring. As a minimum, an "On-Off-Automatic" switch shall be provided at each starter or piece of equipment.

D. Any exceptions to the preceding portions of this specification (which are minimum requirements unless indicated otherwise), shall be as noted by the equipment schedule(s) and/or the drawings.

E. Contractor shall provide sources of 120 volt power to temperature or other control systems as required by the system supplier and/or contractor. Coordinate and/or verify control panel locations and connection requirements with the system supplier and/or contractor.

F. As required elsewhere in the drawings and specifications, and by code, various portions of the building systems such as HVAC, elevator, smoke control, etc. may be controlled and/or monitored by the fire alarm and/or similar systems. This will require on site coordination between the various systems and trades to accomplish the required end result. For example, the details of the smoke damper control and/or shutdown will be the result of on-site coordination between the temperature control and fire alarm systems sub-contractors, as a minimum.

G. Provide connections for motors and equipment as indicated by the Motor and Equipment Connection Schedule following this specifications section.

H. Provide connections for commercial kitchen equipment as indicated by the Kitchen Equipment Connection Schedule following this specifications section.

I. Following are equipment and their respective electrical connections.

2.2 FANS & SIMILAR EQUIPMENT

A. For all fans and similar equipment, provide a starter or adjustable speed controller and disconnect switch of the proper size and configuration, and a power connection to the unit. Where starters are used, a combination starter/disconnect may be provided at the contractor's option. Typical equipment shall include, but not be limited to, the following:

1. Exhaust Fan (EF).
2. Power Roof Ventilator (PRV).

B. Fans, etc. shall be provided with manual motor starters where indicated to be controlled locally or with room lighting, or where no specific type of control is indicated. Manual motor starters may satisfy the disconnect switch requirements for units with loads under 1000 VA at 120/277 volts, single phase.

C. Fans, etc. shall be provided with magnetic starters where indicated to be interlocked with other equipment, or where indicated to be controlled by temperature or other control systems.

D. Control wiring and connections shall be provided by the Division 26 Contractor unless noted otherwise.

E. Ground fault interrupting receptacles with weatherproof cover-plates shall be provided at each rooftop or exterior building mounted unit. Connect to the nearest receptacle power circuit. Receptacle(s) connected to the HVAC unit's electrical branch circuit wiring will not be acceptable.

2.3 FAN POWERED HEATING EQUIPMENT

A. For all fan powered heating equipment, provide a disconnect switch of the proper size and configuration, and a power connection to the unit. Typical equipment shall include, but not be limited to, the following:

1. Cabinet Unit Heater (CUH).
2. Unit Heater (UH).
3. Fan Coil Unit (FC).

B. For equipment provided with an integral aqua-stat, the Contractor shall make connection to motor through the aqua-stat which is furnished and installed by the Division 23 Contractor.

C. For equipment controlled with a BAS relay, the Contractor shall make connection to motor through the BAS relay which is furnished by the Division 23 Contractor.

D. Control wiring and connections shall be provided by the Division 23 Contractor unless noted otherwise.

E. Control wiring and connections shall be provided by the Division 26 Contractor unless noted otherwise.

2.4 REFRIGERATION & COMPRESSOR EQUIPMENT

A. For refrigeration and compressor equipment, provide a fused disconnect switch of the proper size and configuration, and a power connection to the unit. Match fuse size to the maximum overcurrent protection rating noted on the equipment as specified by NEC. Typical equipment shall include, but not be limited to, the following:

1. Condensing Unit (CU).

B. Control wiring and connections shall be provided by the Division 26 Contractor unless noted otherwise.

C. Provide electrical connection for walk-in coolers and freezers. Walk-in units contain integral door heaters, drain freeze protection, and lighting fixtures. Provide light switch with pilot light and time-clock at location external to unit.

D. Ground fault interrupting receptacles with weatherproof cover-plates shall be provided at each rooftop or exterior grade mounted unit. Connect to the nearest receptacle power circuit. Receptacle(s) connected to the HVAC unit's electrical branch circuit wiring will not be acceptable.

2.5 PACKAGED EQUIPMENT

A. For roof top mounted equipment, provide a weatherproof fused disconnect switch of the proper size and configuration, and a power connection to the unit. Match fuse size to the maximum overcurrent protection rating noted on the equipment as specified by NEC. Typical equipment shall include, but not be limited to, the following:

1. Roof Top Unit (RTU).

B. Temperature and other system control wiring and connections shall be provided by the contractor providing the controlling system.

C. Ground fault interrupting receptacles with weatherproof cover-plates shall be provided at each rooftop or exterior grade mounted unit. Connect to the nearest receptacle power circuit. Receptacle(s) connected to the rooftop unit's electrical branch circuit wiring will not be acceptable.

2.6 BOILERS

A. For boilers (B), provide a lockable disconnect switch of the proper size and configuration, and a power connection.

B. Provide shut down as required by code. Shut down shall include the following:

1. Push button shall be located at the exit (outside the room) to each door serving the boiler room.

2. Push button assembly shall be a Cutler Hammer 10250T7019 or prior approved alternate. Push button shall have a red aluminum mushroom head with "emergency stop" engraved on the face of the button. The device shall be maintained contact with (1) NO and (1) NC contact and pilot light. The enclosure housing shall be die-cast and protected with a clear, non-locking Lexan cover to protect against inadvertently bumping the button.
3. Provide engraved placard stating, “Boiler Shut-down”.

2.7 WATER HEATERS

A. For electric or other water heaters requiring an electrical connection, provide a lockable disconnect switch of the proper size and configuration, and a power connection. Typical equipment shall include, but not be limited to, the following:

1. Water Heaters (WH).
2. Instantaneous Water Heaters (IWH).
3. Electric Water Heater (EWH).

B. A lockable motor rated toggle switch may satisfy the disconnect switch requirements for heaters with loads under 1500 VA at 120 or 277 volts, single phase.

C. Provide #6 awg insulated bonding jumper between hot water connection and cold-water connection.

D. Provide shut down as required by code. Shut down shall include the following:

1. Push button shall be located at the exit (outside the room) to each door serving the Mechanical room.
2. Push button assembly shall be a Cutler Hammer 10250T7019 or prior approved alternate. Push button shall have a red aluminum mushroom head with "emergency stop" engraved on the face of the button. The device shall be maintained contact with (1) NO and (1) NC contact and pilot light. The enclosure housing shall be die-cast and protected with a clear, non-locking Lexan cover to protect against inadvertently bumping the button.
3. Provide engraved placard stating, “Water Heater Shut-down”.

2.8 DAMPERS

A. For motorized dampers, provide a disconnect switch of the proper size and configuration, and a power connection. Typical equipment shall include, but not be limited to, the following:

1. Motorized Dampers (MD).
2. Fire/Smoke Dampers (FSD).

B. For every fire smoke damper provide a 120-volt, fractional horsepower connection with MMS at damper. In addition, provide a local actuation type smoke duct detector in every fire smoke damper for control of the associated damper. Upon local alarm the fire smoke damper shall close and send a supervisory signal to the fire alarm system. Provide the required control module, monitor module, relays and wiring for control of fire smoke damper as required to meet the requirements of the Authority Having Jurisdiction.

C. Interconnections with other equipment and controls shall be provided by the contractor providing the controlling system.

2.9 PUMPS

A. For pumps, provide a starter or adjustable speed controller and disconnect switch of the proper size and configuration, and a power connection. Where starters are used, a combination starter/disconnect may be provided at the contractor's option. Typical equipment shall include, but not be limited to, the following:

1. Heating Water Pump.
2. Domestic Circulation Pump.
3. Circulating Pumps.
4. Sump Pump.

B. For all pumps controlled by and/or interlocked with the temperature or other control system(s) magnetic motor starters shall be provided.

C. All pumps which are controlled manually, or where no specific control type is indicated, shall be provided with manual motor starters. Manual motor starters may satisfy the disconnect switch requirements for units with loads under 1000 VA at 120/277 volts, single phase.

D. Temperature and other system control wiring and connections shall be provided by the contractor providing the controlling system.

2.10 ARCHITECTURAL EQUIPMENT

A. For all door or other equipment operators, provide a disconnect switch of the proper size and configuration, and a power connection. A manual motor starter may satisfy the disconnect switch requirements for units with loads under 1000 VA at 120/277 volts, single phase. Typical equipment shall include, but not be limited to, the following:

1. Handicap Door Operators (HDO).
2. Overhead Door Operators (OHD).
3. Motorized Projection Screen (MS).
4. Basketball Backboard Operators.

B. Equipment operator controls, control wiring and installation of same, shall be provided by the contractor providing the equipment operator.

2.11 CORD CONNECTED EQUIPMENT

A. For cord connected appliances, etc., provide a receptacle of the proper NEMA size and configuration. Typical equipment shall include, but not be limited to, the following:

1. Electric Water Coolers (EWC).
2. Washing Machines.
3. Clothes Dryers.
4. Copy Machines.
5. Fax Machines.

6. Kitchen Equipment.
7. Vending Machines.

B. For each cord connected appliance indicated, provide a cord and plug set of the proper size and configuration, and connection, where not provided by the appliance or equipment supplier.

C. Receptacles serving electric water coolers shall GFCI protected and be mounted such that the receptacle is hidden by the water cooler enclosure. Coordinate receptacle placement with the contractor/supplier/installer of the unit.

D. Receptacles serving Vending Machines shall be GFCI protected. Coordinate receptacle placement with the contractor/supplier/installer of the unit.

2.12 OWNER RELOCATED EQUIPMENT

A. Provide an overhead cord drop that consists of a Type SO cable with strain relief to all owner relocated equipment.

B. Provide the required coordination with field verification for all electrical connections serving owner equipment. Match the connection as required for a complete installation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Motor starters, disconnect switches, adjustable speed controllers, and wiring devices shall be installed and identified as indicated in previous sections of these specifications.

B. All work shall be coordinated with the contractor/supplier/installer of the equipment being powered/connected, and the controlling systems.

C. Ground equipment according to Division 26 Section "Grounding and Bonding."

END OF SECTION

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SECTION 260500 - 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.
6. Concrete Bases.
7. Fire-stopping.

1.3 SUBMITTALS

A. Product Data: None.

1.4 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, wire-ways, cable trays, and bus-ways 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. This contract shall include all rough-ins into factory assembled pre-cast panels.

1. Labor and material for recessing Division 26 and Division 27 raceways in precast panels shall be included in this contract and are the responsibility of the Division 26 contract.

C. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07 8413 Section "Penetration Fire-stopping."."

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 may be used at non-fire or smoke rated walls.

B. Sleeves for fire and smoke rated walls and floors shall be a UL tested and classified ASTM E814 (UL 1479) device.

2.2 SLEEVE SEALS

A. Description: Modular sealing / pathway device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ez Path.
b. Hilti Speed Sleeve.
c. Prior approved alternate.

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.

2.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

PART 3 EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wire-ways, cable trays, or bus-ways 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 fire-stop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.”.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable

penetration sleeves with fire-stop materials. Comply with requirements in Division 07 Section "Penetration Fire-stopping."

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 cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 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 CUTTING AND PATCHING

A. Each trade shall perform all cutting and patching necessary in order to perform the work. All patching shall be performed in such manner as to leave no visible trace and to return the part affected to the condition of undisturbed work. Patching work shall be performed by persons experienced, skilled, and licensed for the particular type of work involved. Inferior work will not be accepted. All holes in masonry shall be drilled with rotary drills. Impact tools shall not be used.

B. Each trade shall bear the expense of all cutting, patching, repairing, or replacing of the work of other trades required because of his fault, error, or tardiness or because of any damage done by him.

3.5 FIRESTOPPING

A. Provide fire stopping and fire sealant for all electrical penetrations at all rated walls.

B. Apply fire-stopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Fire-stopping materials and installation requirements are specified in Division 07 Section 07 8413 "Penetration Fire-stopping."

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & 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.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 27 Sections for Low Voltage and Communications Cabling used for voice and data circuits.

1.3 SUBMITTALS

A. Product Data: None.

B. Field quality-control test reports.

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. Comply with NFPA 70.

1.5 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

B. Coordinate with existing devices in pre-cast wall panel under a previous bid package.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW THHN-THWN XHHW.

D. Multiconductor Cable: Multiconductor cable such as armored cable, Type AC metal-clad cable, Type MC nonmetallic-sheathed cable, Type NM and Type USE may not be used in the project unless noted otherwise.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

1. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Light fixture wiring - Type THHN-THWN, single conductors in raceway that includes purple and grey wiring for fixture dimming or Type MC Luminary cable from junction box at ceiling to fixture. Homerun wiring shall be in conduit unless noted otherwise.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. 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. All splices for line and low voltage systems shall be made in a junction box.

3.5 FIRESTOPPING

A. Apply fire-stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 8413 Section "Penetration Fire-stopping."

3.6 FIELD QUALITY CONTROL

A. 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 equipment and services 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.

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

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment, including:

1. Grounding conductors.
2. Electrical Grounding bus.
3. Telecommunications Main Grounding bus (TMGB).
4. Telecommunications Grounding bus (TGB).
5. Grounding of low voltage equipment.
6. Grounding connectors.
7. Grounding electrodes.
8. Underground distribution grounding.
9. Foundation steel electrodes.
10. Ground bonding common with lightning protection system.
11. Grounding for electrical motor generators.
12. Grounding techniques associated with Transient Voltage Surge Suppression.
13. Grounding for Communication Sites utilizing Motorola R56 guidelines.

1.2 SUBMITTALS

A. Product Data: For each type of grounding device required. Include dimensions and manufacturers' technical data on features.

B. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Ground rods.
2. Ground rings.
3. Halo ground rings.
4. Grounding arrangements and connections for separately derived systems.

C. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.4 ELECTRICAL GROUNDING BUS

A. Grounding Bus: Rectangular bars of annealed copper, ¼" by 4" X 20" in cross section, unless otherwise indicated; with insulators.

1. Use 1-1/2" insulated spacer; space from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
2. Equipped with stainless steel mounting brackets and all necessary mounting accessories (bolts, washers, etc.).
3. Ground bus shall be equipped with pre-drilled lug locations.

    a. Provide (51) 7/16" holes, to accommodate 'B", "C", and "D" spaced 2 hole lugs.

4. Ground bars shall be provided with a dead-front plexiglass cover.
5. UL listed.
6. Approved manufacturers and product number: Harger #GBIP14420JMGB or prior approved alternate.
7. Grounding buses located at the exterior of the building shall be equipped with exterior, weatherproof equipment suited for installation in an exterior environment, resistant to UV rays and oxidization.

2.5 TELECOMMUNICATIONS MAIN GROUNDING BUS (TMGB)

A. Grounding Bus: Rectangular bars of annealed copper, ¼" by 4" X 20" in cross section, unless otherwise indicated; with insulators.

1. Use 1-1/2" insulated spacer; space from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
2. Equipped with stainless steel mounting brackets and all necessary mounting accessories (bolts, washers, etc.).
3. Ground bus shall be equipped with pre-drilled lug locations.

    a. Provide 24 sets of 5/16" holes on 5/8" centers.
    b. Provide 6 sets of 7/16" holes on 1" centers.

4. Ground bars shall be provided with a dead-front plexiglass cover.
5. UL listed.
6. Approved manufacturers and product number: Harger #GBIP14420TMGB or prior approved alternate.
7. Grounding buses located at the exterior of the building shall be equipped with exterior, weatherproof equipment suited for installation in an exterior environment, resistant to UV rays and oxidization.

2.6 TELECOMMUNICATIONS GROUNDING BUS (TGB)

A. Grounding Bus: Rectangular bars of annealed copper, ¼" by 4" X 12" in cross section, unless otherwise indicated; with insulators.

1. Use 1-1/2" insulated spacer; space from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
2. Equipped with stainless steel mounting brackets and all necessary mounting accessories (bolts, washers, etc.).
3. Ground bus shall be equipped with pre-drilled lug locations.

    a. Provide 6 sets of 5/16" holes on 5/8" centers.
    b. Provide 3 sets of 7/16" holes on 1" centers.

4. Ground bars shall be provided with a dead-front plexiglass cover.
5. UL listed.
6. Approved manufacturers and product number: Harger #GBIP14212TGB or prior approved alternate.
7. Grounding buses located at the exterior of the building shall be equipped with exterior, weatherproof equipment suited for installation in an exterior environment, resistant to UV rays and oxidization.

2.7 GROUNDING OF LOW VOLTAGE EQUIPMENT

A. Vertical Rack Bus-bar shall be installed on each equipment rack/cabinet and shall be the following requirements:

1. Constructed of 1/4"x5/8"x72" hard drawn electrolytic tough pitch 110 copper alloy with thirteen sets #1/4x20 tapped mounting holes of 5/8" centers.
2. The bus-bar shall have two sets of 5/16" self-clinching studs on 1" centers at both ends for attachment of a ground conductor.
3. UL Listed.
4. Approved manufacturers and product number: Chatsworth (40160-072) or equal.

B. Ground Terminal Block shall be installed on all racks and cabinets and shall meet the following requirements:

1. Constructed of high strength aluminum with two hole mounting attachment and stainless steel set screws.
2. Accepts #14 AWG through 2/0 conductors.
3. UL Listed.
4. Approved manufacturers and product number: Chatsworth (40167-001) or equal.

C. Clean-Thread Screws shall be provided for the installation of ground conduction hardware on painted finishes of racks and cabinets. Clean-Thread screws shall be #12-24 with a zinc finish, Chatsworth (40605-001) or equal.

D. C-Type Compression Taps shall be used when connecting two TBB copper conductors. Compression taps shall be Chatsworth (40163-0xx) or equal; sized correctly to match conductor size.

2.8 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. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

C. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe connectors: clamp type, sized for pipe.

D. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

F. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

G. 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.

2.9 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturers recommended material.

PART 3 EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.
5. Apply an antioxidant coating to all crimp-on-type connectors prior to making crimp. Wipe connectors clean.
6. Equipment Connections to Bus Bars: Two-holed irreversible crimp-on-style connectors with stainless steel bolt, nut and lock washers.

F. Grounding at the Service:

1. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

G. Grounding of Separately Derived Systems:

1. Generators Connected with 3-Pole Transfer Switch: Ground generator at its ground grid connected to the building service ground. Provide ground conductors and bond the generator to the electrical service per NEC.
2. Generators Connected with 4-Pole Transfer Switch: Install grounding electrode in the form of ground rod at the generator location to establish separately derived ground at generator. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

H. Bonding of Building Additions:

1. Where new building additions are included in project scope, bond new and existing steel structures together to form common ground potential.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Provide ground rod, and grounded neutral or grounded phase conductor, to ground supply transformer to meter socket and each service disconnection means, or as required by Utility.

C. Lighting Poles: Provide equipment grounding conductor from panel to pole. Provide ground rod below grade near base of pole. Bond equipment grounding conductor with ground rod, pole ground lug and luminaire ground.

D. Electrostatic Discharge Flooring: Install insulated equipment grounding conductor to electrostatic flooring. Provide multiple ground plates and lengths of copper tape as required by flooring manufacturer. Install as recommended by flooring manufacturer. Regularly test resistance to ground during installation and adjust number of flooring grounds accordingly.

E. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

F. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs (where cables are allowed by Section 260519 Low-Voltage Electrical Power Conductors and Cables).
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. 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.

G. 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 panel-board grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
3. Provide a ground connection from ground bus to all phone, radio, data equipment rack.

3.4 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.

C. Terminate each grounding conductor at its own terminal lug. Sharing a single lug by multiple conductors is not allowed.

D. 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.

E. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

F. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

G. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

H. 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.

I. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

J. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

K. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

L. Communication System Grounding:

1. Grounding and Bonding System for Communications shall be an isolated grounding system with a single ground point. That ground point is to be the common grounding electrode system at the building electrical service entrance (main ground bar located in electrical room).
2. The system shall be compliant with ANSI J-STD-607-B with the exception that the ground cable shall not be bonded to building steel except at the electrical service entrance.
3. Provide Grounding Busbar for Telecommunications at each Telecommunications Room, the Main Equipment Room and at the electrical service entrance per project drawings.
4. Provide Telecommunications bonding conductor from the TMGB to Telecommunications Grounding Busbar (TGB) at each Telecommunication Room.
5. Provide Telecommunications Bonding Conductor from Telecommunications Main Grounding Busbar (TMGB) at the Communications Entrance Facility to building common grounding electrode system. Attach grounding conductor to building steel as allowed only at the main electrical service entrance.
6. The Telecommunications Main Grounding Busbar (TMGB) shall be bonded to the main electrical service entrance ground bus.
7. Telecommunications Grounding Busbars (TGB) shall be bonded to the (TMGB).

M. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.5 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor/s and grounding equalizer.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned Drawings locating each 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. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment, or Electro-Static Discharge Flooring: 1 ohm.
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. 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.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

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. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
3. 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. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

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 scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch 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. Ceiling support wires shall not be utilized to support power, signaling or communications raceways or cables. Independent support wires used for support can be attached to a nonfire-

rated assembly. These support wires shall be distinguishable by color, tagging or similar method.

D. 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.

E. 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: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
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.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 "Cast-in-Place Concrete".

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

A. Touchup: Comply with requirements in Division 09 Painting for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

1. If no such paint section exists then touch-up as follows:

a. 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.
b. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 260533 - 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.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior duct-banks, manholes, and underground utility construction.

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: Liquid-tight flexible metal conduit.

F. NBR: Acrylonitrile-butadiene rubber.

G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: None.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For hand-holes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

f. Floor boxes.

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. Manufacturers: Subject to compliance with requirements, provide products by one of 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. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. Fittings for Conduit (Including all Types and Flexible and Liquid-tight), 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, compression type. Set screw indentor type not allowed.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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-40-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 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for general-use installation.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
3. Thomas & Betts Corporation.
4. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Where noted as 4-inch square boxes provide a junction box with a minimum dimension of 4-inches wide by 2-1/8-inches deep. The box must accept a 1-inch conduit.

D. Basis of design shall be Hubbell 8231 Series or approved equal.

E. Plenum Boxes:

1. Devices installed in a plenum space shall be plenum rated when an air tight enclosure is required by the NEC.

a. Plenum rated boxes shall be equipped with a gasketed cover and knock-outs prepared for plenum usage.

b. Basis of design shall be Hubbell 239-plenum Series or approved equal.

F. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panel-boards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 EXTERIOR WET LOCATION JUNCTION BOX AND COVER

A. All exterior receptacles shall be GFI type with a hinged, gasketed, self closing, outlet cover/enclosure and gasketed between the enclosure and mounting surface. The cover shall be rain-tight while-in-use cover with gray die cast aluminum. The enclosure die cast aluminum and UL listed and labeled for wet location and have locking covers.

1. Manufacturer:

a. Cooper WLRD series.
b. Prior approved alternate.

B. Match Box and cover.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Green.
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." "TELEPHONE."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Hand-holes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Fiberglass Hand-holes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.

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 a comparable product by one of the following:

a. Carson Industries LLC.
b. Nordic Fiberglass, Inc.

PART 3 EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: IMCRNC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-40-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. Exposed Boxes in Garage and Vehicle Sallyport area: Bell Boxes.
7. Application of Hand-holes and Boxes for Underground Wiring:

a. Hand-holes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
b. Hand-holes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Indoors - comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: IMC. Includes raceways in the following locations:

a. Loading dock.
b. Within Secure Perimeter Areas.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.

6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
10. Fire Alarm System: EMT that shall be RED Color.

    a. All fire alarm cabling shall be installed in a conduit raceway system.

C. Minimum Raceway Size:

1. 3/4-inch for Power Systems.
2. 1-inch for communications.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

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 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 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 ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC 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 tensile strength. Leave at least 12 inches 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. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
2. 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. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches 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 subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

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.

P. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12

inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified by Civil Engineers specifications.

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 of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install hand-holes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install hand-holes and boxes with bottom below the frost line, 5’-0” 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 FIRESTOPPING

A. Apply fire-stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Fire-stopping materials and installation requirements are specified in Division 07 Section "Penetration Fire-stopping."

END OF SECTION

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements:

a. Type:

1) EPDM rubber.
2) Nitrile (Buna N) where hydrocarbons are present in the soil.

b. 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 or stainless steel.
4. Connecting Bolts and Nuts:

a. Carbon steel with corrosion-resistant coating, or stainless steel.
b. Of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

H. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. The work under this section includes the products and execution requirements relating to labeling of power, control, and signal wiring. Further, this section includes the installation of labels, nameplates, and directories for electrical junction boxes, wiring devices, and electrical equipment.

B. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 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 GENERAL

A. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.3 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 shall indicate type of underground line. Utilize red-colored tapes for line voltage lines (ELECTRIC LINE, HIGH VOLTAGE, etc). Utilize orange-colored tapes for low voltage lines: (TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE, etc).

C. Description:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft.
5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 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. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning:

    a. "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
    b. Revise dimension as required to meet working spaces as defined in Article 110.26 of NFPA 70.

3. Arc Flash Hazard Warning: “DANGER - REMOVAL OF COVER EXPOSES POTENTIAL ELECTRIC ARC FLASH HAZARD”.
4. Provide a sign at the service-entrance equipment indicating type and location of on-site emergency power sources and on-site legally required standby power sources, per NEC 700.7 and NEC 701.7.
5. Fire pump disconnects shall be marked as “Fire Pump Disconnecting Means”, per NEC 695.4(B)(3)(c).
6. Provide a sign at each service disconnect indicating “Service Disconnect”, and locate at the switch or circuit breaker, per NEC 230.70(B).

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. 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. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 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.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

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.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.1 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. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent. Install all labels firmly as recommended by the label manufacturer. Labels shall be installed plumb and neatly on all equipment.Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Junction and pullbox identification: The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Secondary Power - 208Y/120V, 240/120V	White
Emergency System - Life Safety Branch (NEC 700) - 208Y/120V	White/Red
Legally Required Standby System (NEC 701) - 208Y/120V	White/Blue
Optional Standby System (NEC 702) - 208Y/120V	White/Yellow
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Gray
Video Surveillance System/MATV	Yellow
Data	Blue

1. Additional required junction and pullbox identification shall include:

    a. Where exposed, junction boxes larger than 8” square shall utilize engraved nameplates with ½” minimum letter height. Identify system source(s) and load(s) served.
    b. Where exposed, 8” square and smaller junction boxes shall utilize machine generated, adhesive labels.
    c. Where located above an accessible ceiling, junction boxes may be neatly identified using a permanent marker.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    b. Colors for 208/120-V Circuits:

        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.

    c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or

taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Panelboard Directories: Typed directories for panels must be covered with clear plastic, and have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

F. Wiring Device Identification: Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through fittings, access floor boxes, photocells, and time clocks shall be identified with circuit numbers and source (ex. Panel ABC-#). In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated adhesive labels.

G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. 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.

J. 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.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

L. 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.

M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

N. 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:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Stenciled legend 4 inches high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. 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.
e. Provide labeling with respect to NEC 110.16 for Arc Flash protection labeling.
f. The labeling structure for equipment shall include the following information on the device being labeled:

1) Name of device.
2) What it is fed from.
3) What it feeds.

a) And example “Transformer (T-5) fed from Switchboard (SWBD) feeding Panel-board (LT-1).

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Emergency system boxes and enclosures.
g. Enclosed switches.
h. Enclosed circuit breakers.
i. Enclosed controllers.
j. Variable-speed controllers.
k. Push-button stations.
l. Power transfer equipment.

m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION

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SECTION 260700 - COMMUNICATION RACEWAY

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.

B. All Division 27 Specifications Sections.

1.2 SUMMARY

A. This Section includes the following:

1. Communication raceway systems from the service entrance, distribution and receptacle facilities.
2. Communications raceway systems shall include, but are not limited to telephone and computer/data systems, etc.
3. Raceways and wiring for Security Systems Division 28 shall be furnished and installed by the Division 26 contractor. Testing of cabling is the responsibility of the cable installer.
4. All wiring for Division 28 shall be installed in conduit to point of use or junction box adjacent as required unless otherwise noted. All equipment, components, wiring and final terminations, etc shall be furnished and installed by Division 28.
5. Division 26 Contractor shall provide 120-volt wiring to equipment head end equipment for Division 27 and Division 28 contracts.
6. Raceways for Division 27 shall be furnished and installed by the Division 26 Contractor. All equipment, components, wiring and final terminations etc. shall be furnished and installed by Division 27.

B. Provision and installation of communication system(s) cabling and devices, etc. shall be as specified in Division 27.

1.3 SUBMITTALS

A. Product Data:

1. None.

PART 2 PRODUCTS

2.1 SPACE REQUIREMENTS

A. Communications Receptacle Locations.

1. Communications receptacle locations shall be provided as a 4" x 4" x 2-1/8" outlet box (4” x 4” x 3-1/2” for security cameras) with a 1" metallic conduit to the nearest terminal,

ceiling raceway system, or accessible ceiling space as required. Single gang mud-rings shall be provided for a single type communication outlets, while double gang mudrings shall be provided for combination outlets (i.e. telephone only, data only or other single communication type system - single gang mud-ring, combination data/telephone - double gang mud-ring).

2. All receptacles utilized shall be supplied with cover plates by the communications system(s) supplier/ installer specified in Division 27. Spare or future outlets shall be provided with blank plates to match wiring device plates.
3. Communications receptacles shall be installed at the same height as adjacent duplex receptacles, or as indicated.
4. Communications receptacles shall not be placed in a back-to-back position, but shall be separated by a minimum of 6" or as dictated by NFPA standards for rated assemblies.
5. Provide a nylon pull string to pull wiring in all raceways.
6. Provide plastic insert bushings in the end of each raceway to protect future wiring and cabling.

2.2 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Arnco Corporation.
3. Endot Industries Inc.
4. IPEX.
5. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

PART 3 EXECUTION

3.1 INSTALLATION

A. All conduits shall be rigidly installed, adequately supported and properly reamed at both ends. Conduit types and installation methods shall be as specified elsewhere unless indicated otherwise.

B. Terminate metallic conduits using insulated metallic bushings.

C. The conduits shall be run in the shortest straight runs wherever possible. No section of conduit runs shall be longer than 100 feet or contain more than two 90 degree bends. (A double offset is equal to one 90 degree bend.).

D. For sections of conduit runs longer than 100'-0", or containing more than two 90 degree bends, or containing a reverse bend, pull boxes shall be provided.

E. Bends in conduits, and in particular conduits larger than 2", shall be long sweep radius bends wherever possible. In no instance shall the inside radius of the bend be less than:

1. Six (6) times the internal diameter for conduits 2" and smaller.
2. Ten (10) times the internal diameter for conduits 2 1/2" and larger.

F. Conduits entering communications closets shall have bushings and shall terminate as close as possible near the wall through which the conduits enter.

G. All conduits shall be left clean, dry and free of debris and other obstruction.

END OF SECTION

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SECTION 260800 - ELECTRICAL COMMISSIONING REQUIREMENTS

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.

B. Section 01 91 00 - General Commissioning Requirements.

1.2 SUMMARY

A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

B. Equipment and Systems to be Commissioned:

1. Lighting control systems.

C. The commissioning activities have been developed to support project performance in accordance with the 2015 Minnesota Energy Code requirements developed for the project.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Complete pre-functional construction checklists.

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Participate in electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

G. Provide general commissioning functions for Subcontractors as detailed in Section 01 91 00.

H. Electrical and Mechanical Contractors.

1. The Electrical and Mechanical Contractors shall coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.
2. Participate in warranty review.

1.5 CXA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

1.6 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
5. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.7 COMMISSIONING MEETINGS

A. Attend electrical commissioning meetings including, but not restricted to the following:

1. System Functional Testing:

a. Purpose: To review and coordinate the requirements for verification of total system operations.
b. Schedule: Post equipment start-up, minimum of 21 days prior to substantial completion of electrical systems.
c. Attendance Required: Project Manager and site foremen for the Electrical Contractor.

2. Warranty Review:

a. Purpose: To review system operations and owner issues prior to the end of the warranty period.
b. Schedule: 2 months prior to warranty expiration.
c. Attendance Required: Project Manager and site foremen for the Electrical Contractor.

1.8 CONTRACTOR TESTING

A. Subcontractors shall forward, through the GC, a schedule of specified contractor tests, which include the following:

1. Section 26 51 00: Lighting.

a. Test, calibrate, and set all digital and analog sensing and actuating devices.
b. Check each control point by making a comparison between the control command at the panel and the status of the controlled device.
c. Test the operation of the lighting controls and integral components to verify they respond appropriately to changing conditions and parameters as specified.
d. Validate all interfaces with other systems on a point by point basis.

B. The schedule shall allow at least 1 week's testing notice to the CxA. The CxA reserves the right to witness and document all specified tests.

C. Submit contractors test reports to the appropriate design professionals, as specified, and concurrently to the CxA upon successful completion of each test.

D. The Contractor responsible for the system or component being tested shall be responsible to provide all test equipment necessary to fulfill the testing requirements of this Division.

1.9 SUBMITTALS

A. Certificates of readiness.

B. Reports, forms, test plans and schedules as required by these specifications.

C. Certificates of completion of installation, pre-start, and startup activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 TESTING PREPARATION

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents.

C. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 FUNCTIONAL PERFORMANCE TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.3 COMMISSIONING DOCUMENTATION FORMS

A. The following pages are samples of forms to be utilized in the commissioning process. The actual test procedures will be issued during the construction phase.

Check	Notes
Occupancy Sensors	
Appearance in good condition with no apparent damage	
Fastened securely to surface	
Sensor terminated per manufacturer recommendations	
Control Cable bundled neat and orderly	
Power supply installed and connected	
Time delay set @ _____ minutes	
Line voltage & control wiring terminated	
Sensitivity set to properly prove occupancy	
Sensor head aimed in correct direction to cover space	
Switches and Wall Box Occupancy Sensors	
Appearance in good condition with no apparent damage	
Fastened securely to surface	
Sensor terminated per manufacturer recommendations	
Wired per control diagram to enable dimming circuits	
Switches enable sensors for dimming control	
Photo-electric Switches	
Appearance in good condition with no apparent damage	
Fastened securely to surface	
Sensor terminated per manufacturer recommendations	
Control Cable bundled neat and orderly	
Power supply installed and connected	
Communicating with controller	
Sensor head aimed in correct direction to represent natural light in space	
Orientated per manufacturer recommendations	
General	
Exterior by-pass of photocell installed and operable	
Interior by-pass of photocell installed and operable	
BAS System programmed for lighting control systems	
Exterior lighting contactor installed and operable	
Exterior photocell connected to building automation system.	
Lighting circuits connected to relay panels, contactors, BAS System	
Relay and contactor circuits labeled	

Lights with Inboard/outboard switching is operational	
Operation Manuals submitted to owner	
As-built drawings showing device address accurately noted and available for review	
Sequence of Operation	
Specified sequences of operation and operating schedules have been implemented with all variations documented	

END OF SECTION

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SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. The occupancy sensor lighting control shall automatically turn off lighting when a room or area is vacated. The system shall also provide an input to the Division 23 Building Automation System to prove occupancy within the space. Occupancy sensors shall be equipped with dry contacts (input) points.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Where required, the occupancy sensors shall integrate seamlessly with the lighting control systems.

D. Section Includes:

1. Snap and toggle switches.
2. Wall-box dimmers.
3. Time switches.
4. Photoelectric switches.
5. Standalone daylight-harvesting switching controls.
6. Indoor occupancy sensors.
7. Outdoor motion sensors.

1.2 RELATED DOCUMENTS

A. Section 260943 - Low Voltage Lighting Controls.

B. Sequence of Operation notes on the plans.

1.3 SUBMITTALS

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

B. Shop Drawings:

1. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
2. A custom wiring and interconnection diagram showing proper wiring including wire types and wire quantities for each system.
3. Coordination Drawings: Custom engineered coverage plan, drawn to scale, on which the sensor coverage, location and orientation of the equipment on a floor plan are indicated. The drawings shall be engineered to not interfere with the following:

    a. Lighting fixtures.

b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Structural members.

1.4 SUBSTITUTIONS

A. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For each type of lighting control device the following shall be included in emergency, operation, and maintenance manuals.

a. Provide product cutsheet for each device installed.
b. Provide product installation manual for each device installed.

PART 2 PRODUCTS

2.1 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.
3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Two pole, three pole, four pole shall be similar model to single pole listed above.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221PL for 120 and 277 V.
b. Hubbell; HBL1201PL for 120 and 277 V.

c. Leviton; 1221-LH1.
d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches for stand alone applications, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 24 Volt AC/DC, 3 A; for use with occupancy sensors and power packs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; 1081.
b. Cooper; GMT.
c. Pass & Seymour; 1081.
d. Other approved supplier.

G. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.2 WALL-BOX DIMMERS

A. See Section 260943 - Low Voltage Lighting Controls.

2.3 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. NSi Industries LLC; TORK Products.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST, DPST or DPDT (as required).
3. Contact Rating: as required.
4. Programs: 8 channels; each channel is individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: Selected channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.4 WALL BOX TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Time adjustable from 5 minutes to 12 hours.
3. Single Gang.
4. Contact Configuration: SPST.
5. Contact Rating:

a. 120 VAC:

1) 800 Watt - Tungsten.
2) 800 Watt - Fluorescent.
3) 1/6 HP - Motor.

b. 277 VAC:

1) 1200 Watt - Fluorescent.

6. Zero Arc Point Switching.
7. Visual and audible warnings: Provides a light flicker and/or beep warning prior to turning fixtures off.
8. Operating Environment: Indoor use only. Operating temperature 32d F to 122D F. Relative humidity (non-condensing) 0% to 95%.
9. UL Listed.

2.5 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with SPST or DPST (as required) 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. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. See Section 290943 - Low Voltage Lighting Controls for system photocells.

2.6 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Acuity Lighting.

B. See Section 290943 - Low Voltage Lighting Controls.

2.7 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Acuity Lighting.

B. See Section 290943 - Low Voltage Lighting Controls.

2.8 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Acuity Lighting.

B. See Section 290943 - Low Voltage Lighting Controls.

2.9 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Acuity Lighting.

B. See Section 290943 - Low Voltage Lighting Controls.

2.10 OUTDOOR MOTION SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Acuity Lighting.

B. See Section 290943 - Low Voltage Lighting Controls.

2.11 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller thanNo. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.

C. Coordinate the placement of wall controls with actual installed door swings.

D. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.

E. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

F. Sensors shall be mounted on an approved electrical junction box.

3.2 SENSOR SEQUENCE OF OPERATION

A. Lighting control in spaces shall be controlled as noted on the Plan Sequence of Operation notes.

B. Prior to rough-in and submittal of shop drawings the contractor shall bring to the Engineer’s attention any deviation in the plans from the above controls descriptions.

3.3 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

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. All terminations shall be made in an approved junction box. NO FREE AIR splices will be allowed.

E. Provide neutral conductor, or conduit capacity for future, to all switch locations for switches controlling lighting loads.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Lighting control devices will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13.

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

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SECTION 260943 - LOW VOLTAGE LIGHTING CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes a low voltage lighting control system comprised of the following components:

1. System Software Interfaces.

    a. Smartphone Programming Interface for wired devices.

2. Wired Low voltage Devices.

    a. Wall Stations.
    b. Graphic Wall Stations.
    c. Digital Key Switches.
    d. Auxiliary Input/Output Devices.
    e. Occupancy Sensors.
    f. Wall Switch Sensors.
    g. Embedded Sensors.
    h. Power Packs and Secondary Packs.
    i. Bluetooth® Low Energy Programming Device.

B. The lighting control system shall meet all of the characteristics and performance requirements specified herein.

C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

D. Sequence of Operation notes on the plans.

1.2 RELATED DOCUMENTS

A. Section 262726 Wiring Devices.

B. Section 260923 Lighting Control Devices.

C. Section 265100 Interior Lighting Fixtures.

1.3 SUBMITTALS

A. Submittal shall be provided including the following items.

1. Bill of Materials necessary to install the low voltage lighting control system.
2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
3. Riser Diagrams showing device wiring connections and typical per room/area type.

4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).
5. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
6. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
7. Hardware and Software Operation Manuals.
8. Light fixture submittals will not be released until all the listed items for low voltage controls have been received and reviewed.

1.4 APPROVALS

A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.

C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.

1.5 QUALITY ASSURANCE

A. Product Qualifications.

1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
2. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
3. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. Installation and Startup Qualifications.

1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements.

1. Phone Support: Toll free technical support shall be available.
2. Remote Support: The bidder shall offer a remote support capability.

1.6 PROJECT CONDITIONS

A. Only install equipment after the following site conditions are maintained:

1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C).
2. Relative Humidity: less than 90% non-condensing.

B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above, at any point prior to installation.

C. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

1.7 WARRANTY

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.

B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.8 MAINTENANCE & SUSTAINABILITY

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers.

1. Acuity Brands Lighting, Inc./nLight.
2. Hubbell NX Lighting Controls.

B. Basis of Design System: Acuity Controls nLight.

2.2 SYSTEM COMPLIANCE

A. System components shall comply with UL 916 and UL 924 standards where applicable.

B. System components shall comply with CFR Title 47, Part 15 standards where applicable.

C. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture.

1. System shall have an architecture that is based upon standalone lighting control zones using distributed intelligence.
2. Where noted, intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching,

dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

B. Wired Low voltage Control Zone Characteristics.

1. Connections to devices within a wired lighting control zone shall be with a single type of low voltage cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage cables shall not be permitted.
2. System shall provide the option of having pre-terminated plenum rated low voltage cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.
3. All low voltage devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
4. Low voltage control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired low voltage control devices shall be provided for egress and/or emergency light fixtures:

    a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage cable connection.
    b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.

C. Supported Sequence of Operations.

1. Characteristics and performance requirements herein shall be supported by the low voltage lighting control system.
2. Wall station Capabilities.

    a. Wall stations shall be provided to support the following capabilities:

        1) On/Off of a local control zone and global control zone simultaneously, as required.
        2) Continuous dimming control of light level of a local control zone and global control zone simultaneously, as required.
        3) Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
        4) Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy

sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

b. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” switching, dimming, preset scene, and profile scene control.

3. Occupancy Sensing Capabilities.

a. Local and global control: Occupancy sensors shall be configurable to control a local and global zone simultaneously, as required.
b. Multi-sensor control: multiple occupancy sensors shall be capable of controlling the same local and global control zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
c. System shall support the following types of occupancy sensing sequence of operations:

1) On/Off Occupancy Sensing.
2) Partial-On Occupancy Sensing.
3) Partial-Off Occupancy Sensing.
4) Vacancy Sensing (Manual-On / Automatic-Off).

d. On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:

1) Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.
2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels. To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
3) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.
4) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

e. Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:

1) The use of a wall station is required turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the

previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.

2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels. To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
3) To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an “automatic grace period” immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
4) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.
5) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

f. To accommodate different types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.

4. All zones, presets, schedules and profiles are to be verified with the owner prior to installation. Sequences are for bidding purposes and energy code compliance.

2.4 SYSTEM SOFTWARE INTERFACES

A. Smartphone Programming Interface for Wired Devices.

1. Application interface shall be provided for both Apple iOS® and Android operating systems that allows configuration of lighting control settings.
2. The application shall support the configuration and control of wired low voltage control devices via a Bluetooth® Low Energy (BLE) Programming Device.

a. Application shall support a security pin-code to access the zone of lighting control devices.
b. The application shall provide indication of signal strength where multiple Bluetooth Low Energy Programming Devices are available for configuration.
c. The application shall indicate the number of wired low voltage control devices connected to the local daisy-chain zone.
d. The application shall provide on/off/dimming control of all control groups.
e. The application shall provide the ability to identify all individual luminaires and control devices.

3. Programming capabilities through the application shall include, but not be limited to, the following:

    a. Switch/occupancy group configuration.
    b. Manual/automatic on modes.
    c. Turn-on dim level.
    d. Occupancy sensor time delays.
    e. Dual technology occupancy sensors sensitivity.
    f. Trim level settings.
    g. Preset scene creation and copy for scene capable devices.
    h. Application of a custom device label.

2.5 SYSTEM CONTROLLER

A. Product Series: nECY.

B. Control module shall be a device that facilitates communication and time-based control of downstream devices.

C. Devices shall have a user interface that is capable of wall mounting, powered by lowvoltage and have a touch screen.

D. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.

E. Device shall automatically detect all devices downstream of it.

F. Device shall have a standard and astronomical internal time clock.

G. Device shall have one RJ-45 10/100 BaseT Ethernet connection.

H. Device shall have a USB port.

I. Each control gateway device shall be capable of linking 1500 devices to the management software.

J. Device shall be capable of using a dedicated or DHCP assigned IP address.

2.6 WIRED DEVICES

A. Wired Wall Switches, Dimmers, Scene Controllers.

1. Product Series: nPODM, nPODM xS, nPODM xL.
2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
6. Devices with mechanical push-buttons shall be made available with custom button labeling.

7. Wall switches & dimmers shall support the following device options:

    a. Number of control zones: 1, 2 or 4.
    b. Control Types Supported:

        1) On/Off.
        2) On/Off/Dimming.
        3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.

    c. Colors: Ivory, White, Light Almond, Gray, Black, Red.

8. Scene controllers shall support the following device options:

    a. Number of scenes: 1, 2 or 4.
    b. Control Types Supported:

        1) On/Off.
        2) On/Off/Dimming.
        3) Preset Level Scene Type.
        4) On/Off/Dimming/Preset Level for Correlated Color Temperature.
        5) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
        6) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

    c. Colors: Ivory, White, Light Almond, Gray, Black, Red.

B. Wired Digital Key Switches.

1. Product Series: nPOD KEY, nPOD KEY MNTN.
2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
5. Devices shall have LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.
6. Digital key switches shall support the following device options:

    a. Control Types Supported:

        1) On/Off.
        2) On/Off/Dimming.
        3) Preset Level Scene Type.

4) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
5) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

b. Colors: Ivory, White, Light Almond, Stainless Steel.

C. Wired Auxiliary Input / Output (I/O) Devices.

1. Product Series: nIO-1S, nIO-RLX, nIO-MLO-5STEPA, nIO-MLO-AB, nIO-NLI, nIO-X, nIO-D, nIO-EZ-PH, nIO-EZD.
2. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:

a. Contact closure or Pull High input.

1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.

b. 0-10V analog input.

1) Input shall be programmable to function as a daylight sensor.

c. RS-232/RS-485 digital input.

1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.

d. 0-10V dimming control output, capable of sinking up to 20mA of current.

1) Output shall be programmable to support all standard sequence of operations supported by system.

e. Digital control output via EldoLED LEDcode communication.

1) Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

D. Wired Occupancy Sensors.

1. Product Series: nCM, nCMB, nRM, nWV, nHW.
2. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
3. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
4. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
5. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
6. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
7. System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.
8. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
9. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
10. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.
11. Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
12. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.

E. Wired Wall Switch Sensors.

1. Product Series: nWSX.
2. Devices shall recess into single-gang switch box and fit a standard GFCI opening.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push-buttons shall provide tactile user feedback.
6. Wall switches sensors shall support the following device options:

    a. User Input Control Types Supported: On/Off or On/Off/Dimming.
    b. Occupancy Sensing Technology: PIR only or Dual Tech acoustic.
    c. Colors: Ivory, White, Light Almond, Gray.

7. Wall switch sensors are approved in small private offices only.

F. Wired Low voltage Power Packs and Secondary Packs.

1. Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P-LVR, nSHADE, nAR40, nEPS 60, nPS-80.
2. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
3. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
4. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output but shall not be required to contribute system power.
5. Power Supplies shall provide system power only but are not required to switch line voltage circuit.
6. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
7. When networked communication shall be delivered to each device via standard low voltage cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage cable.
8. Power Pack programming parameters shall be available and configurable remotely from the software or locally via the device push-button.
9. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
10. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
11. Power/Secondary Packs shall be available with the following options:

    a. Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
    b. Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
    c. Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
    d. Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).
    e. Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

G. Wired Low voltage Bluetooth® Low Energy Programming Device.

1. Product Series: nIO BT.
2. Device shall be plenum rated and be inline wired, screw mountable.
3. Communication and low voltage power shall be delivered to device via standard low voltage network cabling with RJ-45 connectors.

4. Bluetooth Low Energy connection shall allow connection from smartphone application for programming device settings within the local daisy-chain zone (see list of available settings in section 2.4-System Software Interfaces, Sub-section E).

    a. Device shall provide visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.

H. Communication Bridges.

1. Product Series: nBRG.
2. Device shall surface mount to a standard 4” x 4” square junction box.
3. Device shall have 8 RJ-45 ports.
4. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
5. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
6. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

I. Relay and Dimmer Panels.

1. Product Series: ARP.
2. Panel shall incorporate 4, 8, 12, 16, 24, 32, 40 or 48 relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads. Relays to be configurable 1, 2 or 3 poles. Relays to be configurable in the field to operate normally open or closed.
3. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
4. Panel shall provide one 1-10 VDC dimming output paired with each relay.
5. Panel shall power itself from an integrated 120/277 VAC supply.
6. Panel shall supply current limited low voltage power to other devices connected via CAT-5.
7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection.
8. Allow for configurable low voltage inputs from indoor/outdoor photocells, sensors and contact closures.

J. Wireguards and Safety Covers.

1. Protective covers Safety Technology International, Inc. Covers to be clear hinged ploy covers, size according to wall mounted control devices shown on plans. Coers to be furnished and installed on wall mounted control devices in locker rooms, gym type spaces as noted on plans.
2. Wireguards by Acuity. Wireguards to be furnished and installed on sensors and associated devices in locker rooms, gym type spaces and additional spaces as noted on plans.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Installation Procedures and Verification.

1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
2. The successful bidder shall install and connect the low voltage lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:

    a. Wire Map (continuity, pin termination, shorts and open connections, etc.).
    b. Length.
    c. Insertion Loss.

4. All wall mounted controllers are to be labeled. Stickers are not an approved label. The off button is to say "Off".

B. Documentation and Deliverables.

1. The installing contractor shall be responsible for documenting installed location of all devices. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:

    a. As-Built floor plan drawings showing daisy-chain wired control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
    b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.

        1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image: Titleblock:

            a) Text- Inclusive of room names and numbers, fixture tags and drawings notes.
            b) Fixture wiring and homeruns.
            c) Control devices.
            d) Hatching or poché of light fixtures or architectural elements.

        2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

C. Installation.

1. It shall be the contractor's responsibility with the manufacturer's assistance to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations noted on the drawings are diagrammatic and indicate only rooms which are to be provided with control. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall coordinate this installation with manufacturer's representative.
2. For rooms and areas that require control, see the plans and sequence of operation notes.
3. The manufacturer’s field services shall have a local presence within the state of construction and their site visit(s) for field inspections, programming and start-up are to be included in the overall installation costs.

3.2 SYSTEM STARTUP

A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.

1. Low voltage cable testing shall be performed prior to system startup.

B. System start-up and programming shall include:

1. Verifying operational communication to all system devices.
2. Programming the network devices into functional control zones to meet the required sequence of operation.
3. Programming and verifying all sequence of operations.
4. Customization of owner’s software interfaces and applications.

C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

3.3 PROJECT TURNOVER

A. System Documentation.

1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.

B. Owner Training.

1. Provisions for onsite training for owner and designated attendees to be included in submittal package. This is to be scheduled with the contractor and owner for a minimum of 8 hours.

END OF SECTION

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SECTION 261423 - ARC FLASH HAZARD ANALYSIS/SHORT-CIRCUIT COORDINATION

PART 1 GENERAL

1.1 SCOPE

A. Provide a short circuit/coordination and arc flash study which includes the protective devices of the switchboards, main switchboard, panelboards, motor control centers and generator(s) (where installed) and equipment in the scope to ensure that all protective relaying and over-current settings meet the coordination requirements and provide appropriate labeling on available fault current and Arc-Flash Hazard warning as required by NEC. Provide arc flash labeling on equipment. Calculations and settings shall be completed by a Registered Professional engineer and the report provided to the engineer (EDI-Dolejs) for review.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 - 2002, the IEEE Guide for Performing Arc-Flash Calculations.

C. The scope of the studies shall include new equipment supplied/installed by the Contractor and existing equipment affected by the area of work for this project.

D. Conditions of the Contract, Division 0 and General Requirements, Division 01 govern work under this section.

1. Sub-Contractors bidding this section shall refer to Section 00810; Special Provisions for Prevailing Wage Rate Requirements that apply to this project.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
2. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings.
3. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
4. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis.
5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations.

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
2. ANSI C37.13 - Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
3. ANSI C37.010 - Standard Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
4. ANSI C 37.41 - Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA).

1. NFPA 70 -National Electrical Code, latest edition.
2. NFPA 70E - Standard for Electrical Safety in the Workplace.

1.4 SUBMITTALS FOR REVIEW/APPROVAL

A. The studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

1.5 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Electronic PDF copies of the report shall be provided upon request.

B. The report shall include the following sections:

1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
2. Short-Circuit Methodology Analysis Results and Recommendations.
3. Short-Circuit Device Evaluation Table.
4. Protective Device Coordination Methodology Analysis Results and Recommendations.
5. Protective Device Settings Table.
6. Time-Current Coordination Graphs and Recommendations.
7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.

9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.
10. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment and the calculated maximum short-circuit current at each bus location, and the disconnects of major HVAC equipment and elevators. Include device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.6 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be an employee of the equipment manufacturer or an approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

1.7 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows (PTW) software program or equal.

PART 2 PRODUCTS

2.1 STUDIES

A. The contractor shall furnish a Short Circuit Coordination and Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies.

2.2 DATA

A. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents to be provided by the Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:

1. Calculation methods and assumptions.
2. Selected base per unit quantities.
3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.
4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings.
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility's overcurrent protective device.
2. Medium-voltage equipment overcurrent relays.
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
4. Low-voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands.
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
6. Medium-voltage conductor damage curves.
7. Ground fault protective devices, as applicable.
8. Pertinent motor starting characteristics and motor damage points, where applicable.
9. Pertinent generator short-circuit decrement curve and generator damage point.
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:

1. A One-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram.
5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
6. Selective coordination shall be completed for Life Safety Branch and 911 optional standby branch.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04).

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Circuits 240V or less where available bolted short circuit current is less than 10 kA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E Table 130.7(C)(9)(a), including footnote 3.

D. Circuits 240V or less fed by transformers 112.5 kVA or less may be omitted from the computer model and will be assumed to have a hazard risk category 0 per IEEE 1584.

E. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

F. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

G. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 5 cycles.

I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

M. Provide the following:

1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

PART 3 EXECUTION

3.1 FIELD ADJUSTMENT

A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. The study engineer shall notify the Design Engineer in writing of any required major equipment modifications.

3.2 ARC FLASH LABELS

A. Contractor shall provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The labels shall be designed according to the following standards:

1. UL969 - Standard for Marking and Labeling Systems.
2. ANSI Z535.4 - Product Safety Signs and Labels.
3. NFPA 70 (National Electric Code) - Article 110.16.

C. The label shall include the following information:

1. System Voltage.
2. Flash protection boundary.
3. Personal Protective Equipment category.
4. Arc Flash Incident energy value (cal/cm^2).
5. Limited, restricted, and prohibited Approach Boundaries.
6. Study report number and issue date.

D. Labels shall be printed by a thermal transfer type printer, with no field markings.

1. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

a. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
b. Wall Mounted Equipment - Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
c. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

E. Labels shall be field installed by Contractor.

END OF SECTION

SECTION 262413 - SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. The switchboards required for this project have been procured directly by the owner. The project intent is that the pre-purchased equipment will be assigned to the electrical contractor and the contractor will be responsible for coordinating with the supplier to receive, install and start the equipment as required. Electrical contractor will also be responsible for the required warranty service for the equipment. Any costs necessary to accommodate these requirements shall be included as part of the project bid.

B. The switchboard will be in a space that is at grade level. Therefore, the switchboard shall include provisions for bottom feed.

C. 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. Identification.

D. This Section includes service and distribution switchboards rated 600 V and less with minimum short circuit rating of 65000 amps.

E. The switchboard will be equipped with Transient Voltage Surge Suppression and Ground Fault Protection.

F. This Section includes providing the main switchboard MSB2 and distribution switchboards MSB2 DIST. 1, and MSB2 DIST. 2 for the new facility. The distribution gear shall be front accessible.

G. This section is included in specification for reference. Owner to purchase equipment. Electrical contractor is to be responsible for receiving the delivery, storage and installation of owner purchased equipment to provide a complete & operational system.

1.2 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 manufacturer specifications and cutsheets, 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 of 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. Wiring Diagrams: Power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. Specified "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.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. 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.

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 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Switchboard and associated equipment shall be delivered Freight On Board (FOB) to CGB School, Graceville, Minnesota.

B. This contract shall include unloading the equipment from the truck and moving to an interior loading dock at the school.

C. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

D. The equipment will be stored indoors in clean dry space with uniform temperature to prevent condensation. However, the product shall be wrapped to protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

E. Handle and prepare switchboards for installation according to NEMA PB 2 and NECA 400.

1.6 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.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB.
2. Note: This equipment was pre-purchased. Alternative suppliers are not applicable.

B. Front -Accessible Switchboards:

1. Provide front-connected, front-accessible switchboards unless specifically noted otherwise to provide front- and side-accessible.
2. Provide integrally mounted transient voltage surge suppression.
3. Provide Main Devices: MSB2 - Main draw-out breaker, individually mounted.
4. Provide Branch Devices: DIST. 1, DIST. 2 - Group mounted.
5. All sections shall be front, and rear aligned.

C. Nominal System Voltage: 208/120 V.

D. Main-Bus Continuous: 2500-amp.

E. Indoor Enclosures: Steel, NEMA 250, Type 1.

1. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray or green finish over a rust-inhibiting primer on treated metal surface.

F. Barriers: Between adjacent switchboard sections.

G. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

H. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard. Bus all sections together with housings of common dimensions.

I. 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. The bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable support shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

J. Removable, Hinged Rear Doors and Compartment Covers:

1. Secured by captive thumb screws, for access to rear interior of switchboard.

K. Hinged Front Panels:Allow access to circuit breaker, metering, accessory, and blank compartments.

L. Buses and Connections: Three phase, four wire, unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, with tin-plated aluminum or copper feeder circuit-breaker line connections.
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. Main Horizontal 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.
4. Vertical Phase Buses: Uniform capacity for entire height of switchboard's main and distribution sections. Vertical bussing shall be a minimum of 100 percent ampacity of the horizontal phase bussing.
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. Ground Bus: 1/4-by-2-inch- 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.
7. 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.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products 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. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, plug-in, solid-state, parallel-connected, modular (with field-replaceable modules) 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. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.
3. Fabrication using bolted compression lugs for internal wiring.
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.
10. Four-digit, transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

D. 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.

E. Protection modes and UL 1449 SVR shall be as follows:

1. For grounded wye circuits with 208/120-V, three-phase, four-wire circuits:

a. Line to Neutral: 800 V.
b. Line to Ground: 800 V.
c. Neutral to Ground: 800 V.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Main Switch: Located in MSB2 - Draw-out Circuit Breaker - Comply with IEEE C37.13.

1. Ratings: Continuous ampacity as indicated on plans. Interrupting and short-time current ratings for each circuit breaker as indicated on plans. Voltage and frequency ratings are the same as switchgear.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB Inc.
    b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    c. Siemens Energy & Automation, Inc.
    d. Square D; a brand of Schneider Electric.
    e. Other approved manufacturers.

3. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:

    a. Normal Closing Speed: Independent of both control and operator.
    b. Slow Closing Speed: Optional with operator for inspection and adjustment.
    c. Stored-Energy Mechanism: Electrically charged, with optional manual charging.
    d. Operation counter.

4. Trip Devices: Solid-state, over-current trip-device system consisting of one or two current transformers or sensors per phase, a release mechanism, and the following features:

    a. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, independent of each other in both action and adjustment.
    b. Temperature Compensation: Ensures accuracy and calibration stability from minus 5 to plus 40 deg C.
    c. Field-adjustable, time-current characteristics.
    d. Current Adjustability: Dial settings and rating plugs on trip units or sensors on circuit breakers, or a combination of these methods.
    e. Three bands, minimum, for long-time- and short-time-delay functions; marked "minimum," "intermediate," and "maximum."
    f. Pickup Points: Five minimum, for long-time- and short-time-trip functions. Equip short-time-trip function for switchable I2t operation.
    g. Pickup Points: Five minimum, for instantaneous-trip functions.
    h. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands: adjustable current pickup. Arrange to provide protection for the following:

        1) Four-wire circuit or system.

    i. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.
    j. Provide shunt trip 24-volt DC.
    k. For breakers 1200 amp and over provide documentation and energy-reducing maintenance switch with local status indicator as required by NEC 240.87.

5. Draw-out type breaker.

B. Feeder Circuit Breakers: DIST. 1, DIST. 2.

1. Provide UL listed and labeled molded case circuit breakers in accordance with the NEC. Comply with UL 489, with interrupting capacity to meet available fault currents.

2. Molded case circuit breakers shall have automatic, trip free, non- adjustable, inverse time and magnetic trips for 100 ampere frame size or less.
3. Molded case circuit breakers shall have automatic, trip free, adjustable - ampere setting (continuous), inverse time and magnetic or electronic trips for 200 ampere frame size or greater. For breakers 400 amps and over solid-state adjustable trip type molded case circuit breakers shall be used.
4. For breakers 1200 amp and over provide documentation and energy-reducing maintenance switch with local status indicator as required by NEC 240.87.
5. Shunt Trip: 120 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage where specified.

C. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

D. 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. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.

E. OVERCURRENT PROTECTIVE DEVICES.

1. 2500-AMP, 3-POLE MAIN SWITCH.
2. Major Mechanical Loads.

    a. RTU-5 - 400-amp, 3-pole.
    b. DUST COLLECTOR - 100-amp, 3-pole.
    c. RTU-3 - 125-amp, 3-pole.
    d. RTU-7 - 110-amp, 3-pole.
    e. RTU-8 - 110-amp, 3-pole.

3. Distribution Panels.

    a. MSB1 - 1200-amp, 3-pole.

4. See schedule on plan sheet for full list of breakers.

2.4 INSTRUMENTATION

A. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four- wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 1 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
d. Megawatts: Plus or minus 2 percent.
e. Megavars: Plus or minus 2 percent.
f. Power Factor: Plus or minus 2 percent.
g. Frequency: Plus or minus 0.5 percent.
h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

B. Impulse-Totalizing Demand Meter:

1. Comply with ANSI C12.1.
2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording 15-minute integrated demand of totalized system.

PART 3 EXECUTION

3.1 INSTALLATION

A. Equipment Mounting: Equipment will be installed on concrete base, 4-inch nominal thickness.

B. Temporary Lifting Provisions: Provide temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

C. 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.

D. Install filler plates in unused spaces of panel-mounted sections.

E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

F. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

B. Switchboard Nameplates:

1. Manufacturer Nameplate:

a. Provide a nameplate on each item of equipment bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

2. Label each switchboard compartment with a nameplate:

a. MSB2.
b. DIST. 1.
c. DIST. 2.

C. Warning Label:

1. Arc Flash Warning Label:

a. Provide warning label for switchgear. Locate this self-adhesive warning label on the outside of the enclosure warning of potential electrical arc flash hazards and appropriate PPE required.

2. Service Entrance Available Fault Curent Label :

a. Provide label on exterior of switchgear used as service equipment listing the maximum available fault current at that location. Include on the label the date that the fault calculation was performed and the contact information for the organization that completed the calculation. Locate this self-adhesive warning label on the outside of the switchgear. Provide the following information:

1) Available fault current information. Do not use the fault current rating of equipment for this value.
2) Date the installation fault calculation was performed.
3) Utility transformer size (kVA).
4) Utility transformer impedance (%).

END OF SECTION

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SECTION 262416 - PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.
2. Electronic-grade panelboards.

1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.3 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 manufacturer specifications and cutsheets.
2. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
3. Detail enclosure types and details for types other than NEMA 250, Type 1.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

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. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Provide manufacturer installation instructions.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.
4. Provide copy of NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

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. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

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 Owner no fewer than five working days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.8 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.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. See plans and schedules for detailed information on individual panelboards.

B. 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. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5 or Type 12, as indicated on schedules.

2. Doors: Door-in-door construction with concealed hinges; secured with flush or multipoint latch with tumbler lock; keyed alike. Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
4. Finishes:

a. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.
b. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
c. Back Boxes: Same finish as panels and trim.

5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top or bottom, contractor’s discretion.

D. 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. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs where indicated: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. Service Equipment Label (where indicated): NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

1. Series rated equipment is not allowed.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: (as indicated on drawings):

1. Circuit breaker.

a. For breakers 1200 amp and over provide documentation and energy-reducing maintenance switch with local status indicator as required by NEC 240.87.

2. Fused switch.
3. Main lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 ELECTRONIC-GRADE PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Liebert Corporation.
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

1. For breakers 1200 amp and over provide documentation and energy-reducing maintenance switch with local status indicator as required by NEC 240.87.

E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

1. For breakers 1200 amp and over provide documentation and energy-reducing maintenance switch with local status indicator as required by NEC 240.87.

F. Buses:

1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
2. Copper equipment and isolated ground buses.

G. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, plug-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, second edition, and matching or exceeding the panelboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors.

1. Accessories:

a. Fabrication using bolted compression lugs for internal wiring.
b. Integral disconnect switch.
c. Redundant suppression circuits.
d. Redundant replaceable modules.
e. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
f. LED indicator lights for power and protection status.
g. Audible alarm, with silencing switch, to indicate when protection has failed.
h. 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.
i. Four-digit, transient-event counter set to totalize transient surges.

2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

a. Line to Neutral: 100,000 A.
b. Line to Ground: 100,000 A.
c. Neutral to Ground: 50,000 A.

4. 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.

a. For 208Y/120-V three-phase, four-wire or 240/120-V, single-phase, three-wire circuits:

1) Line to Neutral: 400 V.

2) Line to Ground: 400 V.
3) Neutral to Ground: 400 V.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. 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. GFCI Circuit Breakers (where indicated): Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers (where indicated): Class B ground-fault protection (30-mA trip).
4. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers (where indicated): Comply with UL 1699; 120/240-V, single-pole configuration.
5. For breakers 1200 amp and over provide documentation and energy-reducing maintenance switch with local status indicator as required by NEC 240.87.
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
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. Shunt Trip (where indicated): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 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. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. 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.

D. Install overcurrent protective devices and controllers not already factory installed.

E. Install filler plates in unused spaces.

F. Spare Conduits for Recessed Panelboards: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates:

1. Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
2. Label service entrance panelboards with available fault current information as well as the date the fault calculation was performed. Do not use fault current rating of equipment for this value. If value is not readily available on plans obtain from project engineer, or if applicable from engineer as specified in 260573 “Overcurrent Protective Device Coordination Study”.

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Provide arc flash labeling as required per NFPA 70 - 110.16 Arc-Flash Hazard Warning.

3.4 FIELD QUALITY CONTROL

A. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

B. Perform tests and inspections.

1. Acceptance Testing Preparation:

a. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
b. Test continuity of each circuit.

2. Tests and Inspections:

a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
c. Perform the following infrared scan tests and inspections and prepare reports:

1) 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.
2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
3) Instruments and Equipment:

a) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. 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

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Tamper-resistant receptacles.
4. Weather-resistant receptacles.
5. Snap switches.
6. Wall Box Dimmers.
7. Solid-state fan speed controls.
8. Communications outlets.
9. Pendant cord-connector devices.
10. Cord and plug sets.
11. Floor box assemblies.
12. Multioutlet assemblies.
13. Emergency power off button.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for snap switches, wall-box dimmers, occupancy sensors, etc.

1.2 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. UTP: Unshielded twisted pair.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

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; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors shall not be used.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

C. Duplex GFCI/USB Convenience Receptacles, 125 V, 20 A:

1. General Description:

a. One - Type A USB port, maximum output of 4.8 Amps @ 5V.
b. One - Type C USB port, maximum output of 4.8 Amps @ 5V.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; GUAC2.

2.5 USB CHARGING DEVICES:

A. Do not use combination duplex receptacles with USB chargers. Use duplex receptacles as required for the application and as specified herein. Use separate 4-port USB charging devices. Both devices shall be mounted in a common box with a single common coverplate.

B. Single-gang 4-port USB charging station. USB ports shall meet UL94 for 5V flammability rating, and shall comply with battery charging specification USB BC1.2. USB ports shall be compatible with USB 1.1/2.0/3.0 devices.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Hubbell USB4*,
2. Leviton USB4P-*,
3. Pass & Seymour TM8USB4*CC6,
4. or approved equal. (* indicates color selection).

2.6 USB CHARGING DEVICES / POWER RECEPTACLES:

A. General Description:

1. Tamper Resistant Straight blade Receptacles, 125 V, 15 A.

2. Grounding Type.
3. One - Type A USB port, maximum output of 2.4 Amps @ 5V.
4. One - Type C USB port, maximum output of 3 Amps @ 5V.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Leviton T5633 - Color or approved alternate.

2.7 TAMPER-RESISTANT RECEPTACLES

A. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR8300.
b. Hubbell; HBL8300SGA.
c. Leviton; 8300-SGG.
d. Pass & Seymour; TR63H.

B. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GFTR20.
b. Pass & Seymour; 2095TR.

2.8 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.
3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Two Pole:

1) Cooper; AH1222.
2) Hubbell; HBL1222.
3) Leviton; 1222-2.
4) Pass & Seymour; CSB20AC2.

c. Three Way:

1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2.
4) Pass & Seymour; CSB20AC3.

d. Four Way:

1) Cooper; AH1224.
2) Hubbell; HBL1224.
3) Leviton; 1224-2.
4) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221PL for 120 and 277 V.
b. Hubbell; HBL1201PL for 120 and 277 V.
c. Leviton; 1221-LH1.
d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.

b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.9 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.

2.10 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.11 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.12 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold/Legrand.

B. Description:

1. Two-piece surface raceway, with factory-wired multioutlet harness.
2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
3. Provide separate channel for communications wiring and devices.

C. Raceway Material: Match Existing.

D. Multioutlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.

2.13 EMERGENCY POWER OFF BUTTONS

A. Provide Emergency Power Off Buttons to de-energize the power to the Shop Panel.

B. Push button assembly for emergency shutdown function shall be:

1. Cutler Hammer 10250T7019.
2. Prior approved alternate.
3. Assembly shall be a push-pull device with a jumbo red aluminum mushroom head with “emergency stop” engraved on the face of the button.
4. The device shall have a maintained contact with (2) NO and (2) NC contact.
5. The enclosure housing shall be Die Cast.
6. Push button enclosure housing shall be protected with a clear, non-locking lexan cover to protect against inadvertently bumping the push button.

C. Label the button per its function:

1. Label with a permanently engraved placard located on or above the device.
2. Example device labels are as follows:

a. Shop Panel Emergency Shut-down.

2.14 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Standard size, 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Finished Spaces: Specification grade, standard size, smooth, high-impact thermoplastic.
4. Material for Unfinished Spaces: Stainless or galvanized steel.
5. Material for Unfinished Spaces: Specification grade, standard size, Smooth, high-impact thermoplastic.
6. Material for Interior damp or wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Damp-Location, Weatherproof Cover Plates: NEMA 250, complying with Nema type 3R, weather-resistant, gasketed and lockable die-cast metal heavy duty cover.

1. Hubbell #MD150-S(gray)-WH(white)-Z(bronze).
2. Or approved alternate manufacturer.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Nema type 3R, weather-resistant, gasketed die-cast metal extra heavy duty cover suitable and listed for In-Use.

1. Hubbell #MX4280-S(gray)-WH(white)-Z(bronze).
2. Or approved alternate manufacturer.

2.15 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Match existing device color unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For thermoplastic covers, match existing color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pig-tailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Repair wall finishes and remount outlet boxes when device plates do not fit flush or do not cover rough wall opening.

E. GFCI Devices:

1. All receptacles installed in bathrooms, kitchens, and within 6 feet of the outside edge of sinks shall be GFCI type.
2. All receptacles installed in outdoor locations, garages, rooftops, and in other damp or wet locations shall be GFCI type with a weather-resistant (WR) rating.
3. GFCI devices shall be installed in a non-feed-thru method. At all locations shown on the drawings, the Contractor shall install individual GFCI device. Where shown as a four-plex device, each device shall be a GFCI device installed in a non-feed-thru manor.
4. GFCI devices shall be installed in readily accessible locations. Coordinate exact location of device with equipment, refrigerators, vending machines, etc. In situations where a GFCI receptacle cannot be located in a readily-accessible area it shall be permissible to feed a standard receptacle with a GFCI breaker or faceless GFCI device, provided that the interrupting device is accessible, clearly marked, and dedicated to the non-accessible receptacle.

F. Tamper-Resistant Devices:

1. Tamper-resistant devices shall be installed in locations as defined by articles #210, 406, and 517 of the National Electrical Code (NFPA 70).

G. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

H. 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.

I. Arrangement of Devices:

1. Unless otherwise indicated, mount flush, with long dimension vertical.
2. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
3. Group adjacent switches under single, multi-gang wall plates.

J. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

K. 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, multi-gang wall plates.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Where a receptacle is designated as a relay controlled receptacle in the documents, per the requirements of AHSREA 90.1. The receptacle shall be clearly labeled to identify the device as a relay controlled device.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION

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SECTION 262813 - FUSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers and motor-control centers.
2. Spare-fuse cabinets.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Include manufacturer specifications and cutsheets.
2. 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.

3. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
4. Current-limitation curves for fuses with current-limiting characteristics.
5. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
6. Coordination charts and tables and related data.
7. Fuse sizes for elevator feeders and elevator disconnect switches.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 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.
4. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 5 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.5 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.

E. Comply with UL 248-11 for plug fuses.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

B. Coordinate fusing with equipment being provided and fuse per manufacturer recommendations. Fusing type shall try to minimize the different fuse types by using Class J whenever possible.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class J.
2. Feeders: Class J, time delay.
3. Motor Branch Circuits: Class J, time delay.
4. Other Branch Circuits: Class J, time delay.
5. Control Circuits: Class J.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "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

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Include manufacturer specifications and cutsheets.
2. Enclosure types and details for types other than NEMA 250, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. 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. Shop Drawings: For enclosed switches and circuit breakers. Include manufactures cutsheet, plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
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.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.5 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 and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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. 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 and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than two weeks 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 written permission of Architect, Construction Manager and Owner.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical 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, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate required fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate required fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate required fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. 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. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products 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, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. 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: Mechanical type, suitable for number, size, and conductor material.

2.3 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Ferraz Shawmut, Inc.
3. Littelfuse, Inc.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

E. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight green ON pilot light.
3. Isolated neutral lug; 200 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; verify coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50.

B. Provide enclosures with ratings to comply with environmental conditions at each type of installed location, unless noted otherwise:

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type as required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install disconnect switches where indicated on Drawings or required by NEC.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Provide custom uni-strut mounting frame where needed to mount switch.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 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.

END OF SECTION

SECTION 262913 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual motor controllers.
2. Enclosed full-voltage magnetic motor controllers.
3. Enclosures.
4. Accessories.
5. Identification.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 MANUAL MOTOR CONTROLLERS

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB (Motion Division).
    b. Eaton.
    c. Schneider Electric USA (Square D).
    d. Siemens Industry, Inc., Energy Management Division.

2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
3. Configuration: Non-reversing.
4. Surface mounting.
5. Green pilot light.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB (Electrification Products Division).
    b. Eaton.
    c. Schneider Electric USA (Square D).
    d. Siemens Industry, Inc., Energy Management Division.

2. Configuration: Non-reversing.
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. Overload Relays: NEMA ICS 2, bimetallic class as schedule on Drawings.
5. Pilot Light: Red.

2.3 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

A. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB (Electrification Products Division).
2. Eaton.
3. Schneider Electric USA (Square D).
4. Siemens Industry, Inc., Energy Management Division.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: Non-reversing.

E. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated.

1. Operating Voltage: Manufacturer's standard, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

G. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.
b. Class 20 tripping characteristic.
c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
d. Ambient compensated.
e. Automatic resetting.

2.4 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

2.5 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Pilot Lights, and Selector Switches: Heavy-duty, except as needed to match enclosure type.

a. Pilot Lights: As indicated in the controller schedule.

B. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.

1. Phase-failure.
2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.
3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.

2.6 IDENTIFICATION

A. Controller Nameplates: as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with drawings and specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, and grounding.
d. Verify the unit is clean.
e. Inspect contactors:

1) Verify mechanical operation.
2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

f. Motor-Running Protection:

1) Verify overload element rating is correct for its application.
2) If motor-running protection is provided by fuses, verify correct fuse rating.

g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

3. Electrical Tests:

a. For the contactor perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
c. Test motor protection devices according to manufacturer's published data.
d. Test circuit breakers as follows:

1) Operate the circuit breaker to ensure smooth operation.
2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.

e. Perform operational tests by initiating control devices.

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

3.4 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain equipment.

END OF SECTION

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of LED luminaires:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Lighting fixture supports.
4. Lighting rebate forms.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Arrange in order of luminaire designation.
2. Physical description of lighting fixture including dimensions.
3. Energy-efficiency data.
4. Include data on features, accessories, and finishes.
5. Include emergency lighting units, including batteries and chargers.
6. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
7. 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. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.

8. Installation instructions.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Installation instructions.

1.5 CLOSEOUT SUBMITTALS

A. Lighting Rebates: Copy of completed lighting rebate forms, including all backup information and receipts.

B. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all equipment used on the Project, use ANSI and manufacturers' codes.

1.6 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.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

E. NSF Compliance: Lighting fixtures for use in commercial kitchens shall be listed and labeled suitable for such use per National Sanitation Foundation (NSF) standards.

F. For LED luminaires comply with:

1. IES-LM-79: Illuminating Engineering Society - Approved Methods: Electrical and Photometric Measurements of Solid-State Lighting Products.
2. IES-LM-80: Illuminating Engineering Society - Approved Methods: Measuring Lumen Maintenance of LED Light Sources.

G. Provide luminaires from a single manufacturer for each luminaire type.

H. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Furnish lighting fixtures completely assembled with wiring and mounting devices and ready for installation at the locations noted. Design and equip recessed fixtures in suspended ceilings for installation in type of ceiling in which the fixture is to be installed. Design fixture to be supported independent of the ceiling.

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. Standards:

1. ENERGY STAR certified.
2. California Title 24 compliant.
3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
5. UL Listing: Listed for damp location.
6. Recessed luminaires shall comply with NEMA LE 4.

D. Rated lamp life of 50,000 hours to L70.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

2.2 MATERIALS

A. Sheet Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
3. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, spring loaded latches shall function easily by finger action without the use of tools. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

D. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

E. Lighting fixtures shall have a specific means for grounding metallic wire-ways and housings to an equipment grounding conductor.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.5 LIGHTING FIXTURE PROVISIONS

A. Coordinate fixture wiring configuration to provide multi-level or dimming with switching schemes as shown on the drawings.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.

E. Wires for Humid Spaces (where indicated): ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.7 WIREGUARDS

A. Description: Welded wire mesh of size and shape for the exit sign, or emergency lighting unit or other device requiring protection.

1. Material: 0.177” diameter (7 gauge) round steel wire.
2. Factory fabricated and furnished by manufacturer of device.
3. Screw eyes provided for mounting.
4. Finish: Chrome plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Lighting fixtures:

1. Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are compatible with specified ceiling type(s) prior to ordering luminaires.
2. Install in accordance with manufacturer’s instructions.
3. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
4. Rectangular and square fixtures surface mounted or mounted in sheetrock, gypboard, plaster or similar ceilings shall be parallel or perpendicular to the building structure and accurately line up with respect to building elements and each other. If fixtures are not initially installed correctly the Contractor shall be responsible for all corrective work required to reinstall fixtures.

C. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Trim ring flush with finished surface.
3. Install at least two independent support rods or wires from structure to tabs on lighting fixture. Utilize tabs on opposite corners of fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3. Per UBC Standard 25-2, Section 25.213.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with hook mount.
3. Install at least two independent support rods or wires from structure to tabs on lighting fixture. Utilize tabs on opposite corners of fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3. Per UBC Standard 25-2, Section 25.213.

G. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
5. Install at least two independent support rods or wires from structure to tabs on lighting fixture. Utilize tabs on opposite corners of fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3. Per UBC Standard 25-2, Section 25.213.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
4. Install at least two independent support rods or wires from structure to tabs on lighting fixture. Utilize tabs on opposite corners of fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3. Per UBC Standard 25-2, Section 25.213.

I. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

J. Remote Mounting of Ballasts or Drivers: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with diver ballast manufacturers, maximum distance between ballast and luminaire.

K. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

L. Provide wire guards for fixtures as specified in the Light Fixture Schedule on the drawings.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

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

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to one visit to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

3.7 CLEANING

A. All luminaires and accessories shall be thoroughly cleaned after being installed. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lenses or louvers prior to final acceptance. All reflectors shall be free of paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufactures' instructions.

3.8 LIGHTING REBATE

A. Contractor shall coordinate with the local power company and the Owner as required to obtain all applicable lamp, ballast, and lighting control rebates. Apply the Utility Lighting Incentive Program for New Construction to this project.

B. Secure on behalf of the Owner the maximum rebate.

C. Complete all forms necessary to secure rebates.

D. All Rebates shall be made directly to the Owner.

E. Provide all invoicing and product information necessary to procure rebate.

END OF SECTION

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SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. 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 Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1. 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.
2. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
6. 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.

G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.

1. 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.
2. Battery: Sealed, maintenance-free, nickel-cadmium type.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the ballast manufacturer, whichever is less.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. 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.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. 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.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard (where indicated): Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay (where indicated): Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test (where indicated): Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test (where indicated): 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.

2.3 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. Remote Test (where indicated): Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test (where indicated): 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 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Glass: Annealed crystal glass unless otherwise indicated.
2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.

2.7 WIREGUARDS

A. Description: Welded wire mesh of size and shape for the exit sign, or emergency lighting unit or other device requiring protection.

1. Material: 0.177” diameter (7 gauge) round steel wire.
2. Factory fabricated and furnished by manufacturer of device.
3. Screw eyes provided for mounting.
4. Finish: Chrome plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Lighting fixtures:

1. Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are compatible with specified ceiling type(s) prior to ordering luminaires.
2. Install in accordance with manufacturer’s instructions.
3. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
4. Rectangular and square fixtures surface mounted or mounted in sheetrock, gypboard, plaster or similar ceilings shall be parallel or perpendicular to the building structure and accurately line up with respect to building elements and each other. If fixtures are not initially installed correctly the Contractor shall be responsible for any and all corrective work required to reinstall fixtures.

B. Comply with NECA 1.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Install at least two independent support rods or wires from structure to tabs on lighting fixture. Utilize tabs on opposite corners of fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3. Per UBC Standard 25-2, Section 25.213.

H. Provide wire guards for exit signs and emergency lighting devices in the following locations:

1. Multipurpose.
2. Gymnasiums.
3. Prison dayrooms.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

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

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

END OF SECTION

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.
4. Poles - Aluminum.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles is per AASHTO LTS-4-M. Wind Importance and Velocity Conversion Factors shall be per Table 3-2. Minimum Design Life shall be per Table 3-3.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Wiring diagrams for power, control, and signal wiring.
6. Photoelectric relays.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
8. 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. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

D. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

F. For LED luminaires comply with:

1. IES-LM-79: Illuminating Engineering Society - Approved Methods: Electrical and Photometric Measurements of Solid-State Lighting Products.
2. IES-LM-80: Illuminating Engineering Society - Approved Methods: Measuring Lumen Maintenance of LED Light Sources.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Provide driver as required for proper operation of fixture.

1. The Driver's maximum case temperature shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design.
2. The use of fans or other mechanical devices shall not be allowed.

B. Housing:

1. The assembly and manufacturing process shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
2. The electronics/power supply enclosure shall be internal to the luminaire and be accessible per UL requirements.
3. The assembly and manufacturing process shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration from winds and other sources.
4. The housing shall be designed to prevent the build-up of water on the top of the housing. Exposed heat sink fins shall be oriented so that water can freely run off the luminaire, and carry dust and other accumulated debris away from the unit.
5. The optical assembly of the luminaire shall be protected against dust and moisture intrusion per the requirements of IP-65 (minimum) to protect all internal components.
6. The electronics/power supply enclosure shall be protected per the requirements of IP-43 (minimum).
7. When the components are mounted on a down opening door, the door shall be hinged and secured to the luminaire housing separately from the refractor or lens frame. The door shall be secured to the housing in a manner to prevent its accidental opening. A safety cable shall mechanically connect the door to the housing.

C. Technical requirements:

1. Fixtures shall be tested and rated per most recent edition of IES LM-79 and IES LM-80, with rated life of 70,000 hours or greater.

    a. Assume each luminaire will operate at an average operating time of twelve hours per day.
    b. Each luminaire is expected to have a minimal operational life of 120 months (ten years).

2. Operating temperature:

    a. Each luminaire shall be designed to operate at an average nighttime operating temperature of 70°F.
    b. The operating temperature range shall be -40°F to +130°F.
    c. Each luminaire is expected to operate at an ambient temperature of 104°F, and to comply with photometric requirements.
    d. Parameters and tests (such as IES-LM-79 and IES-LM-80) shall be conducted at 104°F ambient temperatures.

e. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average nighttime operating temperature.

3. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the rated life.

   a. The maximum junction temperature for the rated life shall not be exceeded at the average operating ambient.
   b. The maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient.

4. The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
5. Power Factor: The luminaire shall have a power factor of 0.90% or greater at all standard operating voltages.
6. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage.
7. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference.

   a. The surge protection which may reside within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 for Location Category A Low. Where failure does not mean a momentary loss of light during the transient event.
   b. Surge protection performance shall be tested per the procedures in ANSI/IEEE C62.45 based on ANSI/IEEE C62.41 definitions for standard and optional waveforms for Location Category A-Low.

8. Operational Performance: The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.
9. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
10. Dimming (where indicated): The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output. Dimming shall be controlled by a 0-10V signal.
11. Lumen Management (where indicated): The luminaire shall be capable of continuously monitoring system performance to allow for constant lumen management / compensation function.
12. Output Color: Minimum CRI 70, and color temperature 3500 K (+/- 100K) unless noted otherwise.

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. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

F. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

G. UL Compliance: Comply with UL 1598 and listed for wet location.

H. In-line Fusing: Separate in-line fuse for each luminaire.

I. Source Limitations: Obtain luminaires from single source from a single manufacturer.

J. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

C. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

2.5 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03 3000 "Cast-in-Place Concrete."

F. Shape, height and material as specified on plans:

1. TRA = Tapered, round, aluminum.
2. Where no material is specified provide aluminum.

2.6 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209, 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Mounting Provisions: Butt flange for bolted mounting on foundation.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
2. Finish: Same as luminaire.

F. Aluminum Finish: 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.

2.7 POLE ACCESSORIES

A. Duplex Receptacle (where indicated): 120 V, 20 A in a weatherproof assembly complying with Section 26 2726 "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 12 inches above pole base.

2. Non-metallic, polycarbonate plastic or reinforced fiberglass weatherproof in use, cover, color to match pole, that when mounted results in NEMA 250, Type 4X enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

C. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept indicated accessories.

D. All poles shall be provided with a factory installed vibration dampening device.

E. Provide banner arms and flag holders where 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 the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Fasten luminaire to structural support.

D. The Contractor shall be responsible for sealing all outdoor luminaires for wet locations (i.e. knockouts, all pipe and wiring entrances, etc.) as is standard industry practice to prevent water from entering luminaires.

E. Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Architect/Engineer.

F. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming.

3.3 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
2. Install base covers unless otherwise indicated.
3. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Raise and set poles using web fabric slings (not chain or cable).

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.6 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "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 Section 260526 "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.

3.7 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.8 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.9 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

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

C. 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.

END OF SECTION

SECTION 267000 - PATHWAYS FOR COMMUNICATIONS AND SECURITY SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All Division 27 and 28 Drawings and Specifications Sections.

B. Specifications Section 26 0526 “Grounding.”.

C. Specifications Section 26 0533 “Raceways & Boxes for Electrical Systems.”.

1.2 SUMMARY

A. This Section includes the following:

1. Communication raceway systems from the distribution and receptacle facilities.
2. Communications raceway systems shall include, but are not limited to telephone and computer/data systems, etc.
3. Raceways for Division 27 shall be furnished and installed by the Division 26 Contractor. Wiring shall be furnished and installed by the Division 27 Contractor.
4. Raceways for Division 28 shall be furnished and installed by the Division 26 Contractor. Wiring shall be furnished and installed by the Division 28 Contractor.
5. Division 26 Contractor shall provide 120-volt wiring to equipment head end equipment for Division 27 and Division 28 contracts.

B. Final installation of communication system(s) devices, etc. shall be provided as specified in Division 27.

PART 2 PRODUCTS

2.1 PLYWOOD PANELS

A. Provide plywood backboard in all terminal and satellite closets and any other indicated locations.

B. Plywood backboards to be made of 3/4" thick plywood, sized as required or as indicated on the drawings.

C. Plywood to be securely anchored to the building partitions to support the weight of switches, terminals and associated hardware.

D. Plywood shall be kept free from all conduits, pipes and electrical receptacles and is to be used only by the Communication(s) Company.

E. Plywood backboards to be made up from fire retardant plywood and painted gray.

F. Provide a 3/4" thick fire retardant plywood termination backboard as indicated and required.

G. Provide a ground bus and ground wiring as specified in Section 26 0526 for each location.

H. Provide a 120 volt double duplex receptacle at the terminal location located at the right of the plywood backboard and mounted at 60".

I. Provide 36" minimum clear work space in front of the plywood backboard.

2.2 RISER / FEEDER CONDUITS

A. Provide a one (1) 4-inch EMT riser or feeder raceway between all satellite terminals unless otherwise noted.

2.3 COMMUNICATIONS RECEPTACLE LOCATIONS

A. Communications receptacle locations shall be provided as a 4" x 4" x 2" outlet box with a minimum 1" metallic conduit to the nearest terminal, ceiling raceway system, or accessible ceiling space as required. Single gang mud-rings shall be provided for a single type communication outlets, while double gang mud-rings shall be provided for combination outlets (i.e. telephone only, data only or other single communication type system - single gang mud-ring, combination data/telephone - double gang mud-ring).

B. All receptacles utilized shall be supplied with cover plates by the communications system(s) supplier/ installer specified in Division 27. Division 26 Contractor shall provide blank plates on all spare or future outlets to match adjacent wiring device plates.

C. Communications receptacles shall be installed at the same height as adjacent duplex receptacles, or as indicated.

D. Communications receptacles shall not be placed in a back-to-back position, but shall be separated by a minimum of 6" or as dictated by NFPA standards for rated assemblies.

PART 3 EXECUTION

3.1 INSTALLATION

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 wire-ways.

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 6 inches 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 dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

F. All conduits shall be rigidly installed, adequately supported and properly reamed at both ends. Conduit types and installation methods shall be as specified elsewhere unless indicated otherwise.

G. Provide a nylon pull string to pull wiring in all raceways.

H. Terminate metallic conduits using insulated metallic bushings. Bushings shall be installed prior to the pulling of any wires.

I. The conduits shall be run in the shortest straight runs wherever possible. No section of conduit runs shall be longer than 100 feet or contain more than two 90 degree bends. (A double offset is equal to one 90 degree bend.).

J. For sections of conduit runs longer than 100'-0", or containing more than two 90 degree bends, or containing a reverse bend, pull boxes shall be provided.

K. Bends in conduits, and in particular conduits larger than 2", shall be long sweep radius bends wherever possible. In no instance shall the inside radius of the bend be less than:

1. Six (6) times the internal diameter for conduits 2" and smaller.
2. Ten (10) times the internal diameter for conduits 2 1/2" and larger.

L. Conduits entering communications closets shall have bushings and shall terminate as close as possible near the wall through which the conduits enter.

M. All conduits shall be left clean, dry and free of debris and other obstruction.

END OF SECTION

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SECTION 267111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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 providing a completely new fire alarm system for the facility which is a combination of E and B environments and includes fire protection (sprinklers) throughout. The scope of work included in the bid scope for this project phase (Phase I) shall include a complete system for all of building Area “C” (new construction) and the new addition at the southwest corner of Area “A” as shown on the plans. The system shall be designed with adequate capacity to allow expansion to cover the remainder of the existing building Area “A” and Area “B” as part of the future Phase II bid scope. The new fire alarm head end will be located the new mechanical room in Area “C” as shown on the plans.

B. The fire alarm system throughout the facility shall be a voice evacuation style with speaker strobes throughout for notification.

C. The whole building includes fire protection (sprinklers) throughout.

D. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Carbon Monoxide Detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Pre-action Sprinkler System/s.
9. Remote annunciator.
10. Addressable interface device.
11. Digital alarm communicator transmitter.

E. The work of this Division shall include providing a complete fire alarm system with all power supplies, wiring, connections, devices, programming, etc. for a complete and fully operational system.

F. All fire alarm system wiring shall be in a conduit raceway suitable for such use. Open air wiring methods is not approved.

G. Related Sections:

1. Section 260445 "Electrical Connections to Equipment" for additional information which pertains to interconnection with equipment.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified or FMG-placarded addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

B. The system shall fully comply with the latest issue of these standards.

1. National Fire Protection Association (NFPA) - USA:
2. Underwriters Laboratories Inc. (UL) - USA:
3. Local and State Building Codes.
4. All requirements of the Authority Having Jurisdiction (AHJ).

1.5 SUBMITTALS

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

B. 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 floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and 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.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
3. Smoke Detectors, Fire 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.

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 II technician.

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 Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company or in the form of a placard by an FMG-approved alarm company.

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 Architect, Construction Manager and Owner no fewer than two weeks in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without written permission from Architect, Construction Manager and Owner.

1.9 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 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.

1.11 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. Smoke Detectors, Fire Detectors: Quantity equal to 2 percent of amount of each type installed, but no less than 1 unit of each type.
2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no less than 1 unit of each type.
3. Keys and Tools: One extra set for access to locked and tamper-proofed components.
4. Audible and Visual Notification Appliances: One of each type installed.
5. Fuses: Two of each type installed in the system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Edwards Signaling.
2. Gamewell/FCI, by Honeywell.
3. Honeywell XLS Series.
4. Notifier, by Honeywell.
5. Simplex.
6. Siemens Building Technologies, Inc.; Fire Safety Division.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:.

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Heat detectors in elevator shaft and pit.
8. Fire standpipe system.

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. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.

8. Recall elevators to primary or alternate recall floors.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe or pre-action sprinkler system.

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.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

F. Fire Smoke Damper:

1. Provide a local actuation type smoke duct detector for local control of every fire smoke damper or smoke damper. Provide relay, control wiring, etc. such that upon alarm condition the damper closes and communicates a signal to the fire alarm control panel. All 120-volt wiring to actuator dampers is by this contract.

G. HVAC Unit Shut-Down.

1. Provide local actuation type smoke duct detector within the return ductwork of every mechanical unit exceeding 2,000 CFM.
2. Upon alarm condition, the fire alarm system shall de-energize all HVAC units that exceed 2000 CFM.

a. Coordinate with Division 23 HVAC Instrumentation and Control.

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 lines of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class/survivability level shall be determined by the NICET-certified designer and include consideration of transmission media, length of conductors, building area and quantity of initiating and notification devices, effect of a fault on performance, nature of hazards present, functional requirements, size and nature of protected population, and input from Owner and authorities having jurisdiction.

a. Initiating Device Circuits: Style D.
b. Notification Appliance Circuits: Style Z.
c. Signaling Line Circuits: Style 6.
d. Install no more than 50 addressable devices on each signaling line circuit.

D. 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.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

H. Instructions: 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.

I. Main fire alarm control panel (FACP) shall be located in the following location:

1. New Boiler Room/Main Service Room.

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. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
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.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

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. 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 Heated 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 CARBON MONOXIDE DETECTORS

A. Description: Carbon monoxide detector listed for connection to fire-alarm system.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.
b. NFPA 720.
c. UL 2075.

2. General Characteristics:

a. Mounting: Adapter plate for outlet box mounting.
b. Testable by introducing test carbon monoxide into sensing cell.
c. Detector must provide alarm contacts and trouble contacts.
d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
e. Locate, mount, and wire in accordance with manufacturer's written instructions.
f. Provide means for addressable connection to fire-alarm system.
g. Test button simulates alarm condition.

2.7 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 135 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

A. 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.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

C. 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- high letters on the lens.

1. Rated Light Output: 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

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 holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

C. Magnetic Door Hold Devices are furnished by Division 08, with final control connections by this contract. The Magnetic door hold devices are 24-VAC with integral door closers. The door closers shall release the doors (close) upon alarm condition. This contract is responsible to provide all 24VAC power (via 120-volt circuit provided by this project).

D. Refer to Specifications Section 08 7100 and 08 7163 for details.

E. Provide all control wiring, transformers, control modules, etc. for a complete and fully operational system.

2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

C. Provide a remote annunciator in the following spaces:

1. Main Vestibule by Admin Office.

2.11 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be

transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address or zone of the supervisory signal.
3. Address or zone of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Material: 0.177” diameter (7 gauge) round steel wire.
2. Factory fabricated and furnished by manufacturer of device.
3. Screw eyes provided for mounting.
4. Finish: Paint of color to match the protected device.

2.14 WIRING

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Conduit shall be used for the following circuits:

1. Between FACP and FAAP.
2. Between FACP and power supply(s).
3. Between FACP, Remote Communication Module, and telephone service point.

C. Initiating circuits (24V dc):

1. Material: Copper.
2. Type: FPLP without conduit, or THHN/THWN in EMT conduit.
3. Size: 14 AWG twisted shielded pair.

a. If devices require a 24V dc power supply independent of communication wiring, provide 2-conductor 14 AWG from power supply.

4. Insulation: 300V minimum, rated at 105°C.

D. Notification circuits (24V dc):

1. Material: Copper.
2. Type: FPLP without conduit, or THHN/THWN in EMT conduit.
3. Size: 2-conductor 14 AWG.
4. Insulation: 300V minimum, rated at 105°C.
5. Each circuit shall have 40% spare capacity.
6. Voltage drop shall not cause any device to operate below its minimum rated voltage.

E. Control and Signal circuits (24V dc or 120V ac):

1. Material: Copper.
2. Type: FPLP without conduit, or THHN/THWN in EMT conduit.
3. Size:

a. Power: 2-conductor 14 AWG 2-conductor.
b. Control: 14 AWG twisted shielded pair.

4. Insulation: 300V minimum, rated at 105°C.
5. Do not run AC and DC circuits inside the same raceway.

F. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely.

G. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

H. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their use and purpose.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

1. Provide fire alarm manual pull station mounted adjacent to the panel.
2. Provide fire alarm photoelectric type initiation device mounted on the finished ceiling within 5 feet of the panel.

D. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

E. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

F. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

H. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

I. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

J. Audible and Audible/Visible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Provide wire guards for devices in the following locations:

1. Gymnasiums.
2. Locker Rooms.
3. Multi-Purpose Room.

M. Provide additional smoke detector at each notification appliance circuit (NAC) extension panel.

N. Minimum Conduit Size: 1/2-Inch trade size conduit.

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. 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 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 activate emergency shutoffs for gas and fuel supplies.
3. Supervisory connections at valve supervisory switches.

C. Provide electrical connections to the following equipment. Connections not necessarily shown on plans.

1. 120V for fire alarm control panel (dedicated circuit).
2. 120V for fire/smoke dampers provided by Div 23.
3. 120V for heated enclosures for weatherproof duct detectors.
4. 24V for door magnetic hold opens.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

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 shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Testing: Perform testing to verify proper operation of the new system, in accordance with NFPA 72- Chapter 10.4.1 - System Testing.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances, in accordance with NFPA 72- Chapter 10.4.1 - System Testing.

E. 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.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Warranty: Contractor shall warrant fire alarm system devices, equipment, wiring, connections, programming, and documentation for correct operation at no cost to Owner, for 1 year minimum.

I. Maintenance Test and Inspection: For one year after Substantial Completion perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

J. 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. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

B. Training shall include 4-hours of on-site technical training to owner.

END OF SECTION

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SECTION 270010 - GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers general installation practices are requirements for all work under Division 27.

B. The General Conditions, Supplementary General Conditions, and Division 01 General Requirements apply to Division 27.

C. The Contractor shall adhere to local ordinances, laws, regulations, the National Electrical Code and OSHA Regulations.

1.2 DRAWINGS & INSPECTION OF SITE

A. Communications floor plan drawings are too scale and are typically not dimensioned. The Contractor shall not scale drawings for equipment placement and clearances. Dimensions given on drawings shall always take precedence over scaled drawings.

B. Any existing wires, utilities, or equipment shown on the drawings are shown for general information and to the best knowledge of the Engineer. The Contractor shall field verify any and all existing wires, utilities, or equipment.

C. The Contractor shall field verify distances and equipment placements coordinating locations with other trades, construction managers, and general contractor prior to installation.

D. The Contractor shall review all site conditions prior to submitting a bid on this project. Any obvious discrepancies between site conditions and bidding documents shall be brought to the attention of the Engineer at the time bidding so clarification can be made by addendum.

E. Change orders requests for additional costs related to the contractors misunderstanding related to the amount of work involved and lack of knowledge related to the site conditions will not be allowed.

1.3 PERMITS, FEES, AND INSPECTIONS

A. All permits, inspections, and licenses required for any communications system under the Division 27 specifications shall be the responsibility of the Contractor. The costs of all permits, fees and inspections shall be included in the Contractor's bid.

1.4 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have at least five (5) years of experience in the installation of similar systems as specified herein and shall have completed at least two (2) projects of similar size and scope within the last 24 months. The contract shall provide references upon request (including the project name, address, date of implementation, client name, title, telephone number, and project description).

B. The Contractor bidding on communication systems specified herein shall be certified by the product manufacturer to install, service, and warranty the specified product prior to the time of bid and throughout the duration of the installation; or, the bidding contractor shall utilize a sub-contractor(s) certified by the product manufacturer to install, service, and warranty the specified product. Manufacturer certifications shall not be project specific and should be valid for any and all projects completed by the Contractor.

C. The Contractor must maintain a Minnesota low-voltage contractor's license as required by the Minnesota State Board of Electricity.

D. The contractor installing the structured cabling shall have a RCDD (Registered Communications Distribution Designer - a designation obtained from Building Industry Consulting Services International) functioning as project manager. The Contractor's RCDD/project manager shall complete the following minimum tasks:

1. Review and submit Contractor's shop drawings.
2. Conduct weekly site visits to review the installation and progress of the structured cabling during the communications installation phase of the project.
3. Review and sign completed punch-list items.
4. Review and submit Contractor's as-built documentation.

E. The Contractor shall provide copies of certificates for proof of manufacturer's training, manufacturer's certified installer, authorized distributor in the shop drawings submittal and at the request of the engineer to verify compliance with specification prior to recommendations for awarding bid.

1.5 SUBMITTALS

A. Submittal for bidding shall be as stated in the Bidding Requirements.

B. Material lists, schedule of values, lists of subcontractors, and proof of contractor qualifications shall be provided to Engineer upon request and shall follow the guidelines as stated in the General Requirements (Division 01 of the specifications).

C. Performance Bonds, Payment Bonds, and Insurance Certificates shall be submitted by the Contractor prior to execution of the contract; refer to General Requirements.

D. Shop drawings shall be submitted as stated in the General Requirements (Division 01 of the specifications). In addition to items stated in the General Requirements, all communication system shop drawings shall include the following items:

1. Manufacturer's data (specifications, "cut sheets").
2. Detail drawing of any custom panels or jack plates.
3. Wiring diagrams for all installed cabling.
4. Equipment rack/cabinet layouts.
5. Proposed labeling schemes and labeling methods.
6. List of cabling distances (typical and maximum) for all structured cabling.
7. Equipment room floor plan layouts.
8. Copy of Contractors training and authorized installer certificates.
9. Copy of structured cabling extended warranty information.

10. Submit shop drawings bound and labeling in accordance with specification section numbers.
11. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. As-Built documentation requirements may be described in additional detail by other Division 27 specification sections. As-built documentation shall include the following items:

1. A copy of the approved shop drawing submittal.
2. A complete list of all materials used on the project.
3. A copy of the Division 27 specifications (include addendum and change orders).
4. Schematic drawings and block diagrams of components.
5. Floor plan drawings including devices locations and labeling.
6. Test results and output level readings (i.e. amplifier loads, RF tap reading).
7. Warranties.
8. Submit a minimum of two (2) copies of all as-built documentation (provide additional copies if more than two (2) copies are required by General Requirements).

F. Close-out documentation shall include all as-built documentation and additional close-out documents as required in the General Requirements.

1.6 MATERIALS AND EQUIPMENT

A. All materials used on this project shall be new. Used and refurbished equipment is not permitted. Provide equipment to site in original packaging whenever practical.

B. The Contractor is responsible for scheduling all deliveries and providing proper receipt, handling, and storage of all materials. Protect all equipment from physical damages (dents, scratches, dust, water, paint, chemicals, and temperature extremes) and vandalism, or theft. The Contractor shall replace any damages or stolen equipment. The Contractor is responsible for all equipment until the final project acceptance by the Owner.

C. All material and equipment used on the project shall be as specified. Approval or substitute material will be considered prior to bidding as described in the instructions to bidders. Applications for prior approval will be considered only from Contractors intending to bid on the project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. All cable, equipment, and components shall be installed in accordance with manufacturer's written instructions, in compliance with NEC, and in accordance with industry standard practices.

B. All equipment shall be installed in a neat, professional manner, always vertically plumb and securely fastened.

C. Most pathways for the communications systems are provided by other trades and not part of the Division 27 work; however, the Division 27 communications contractor may be required to create some pathways. Holes in masonry shall be made with rotary drills; impact tools are not permitted. Never penetrate through structural members or architectural finishes without prior approval from the architect or engineer. All penetration shall be patched, sealed, cleaned, and returned to original conditions. All penetration in fire rated walls and floors shall be sealed with approved fire barriers systems in accordance with manufacturer's instructions.

D. This communications contractor is responsible for creating a waterproof seal in and around openings to the building exterior created by or used by the communications contractor. All waterproof sealing materials shall comply with appropriate codes and shall be installed in accordance with the manufacturer's instructions.

E. The communications contractor shall clean up all debris related to Division 27 work on a regular basis leaving the job site in a clean, safe condition.

F. Where ceilings structures are removed, the Contractor shall include time and materials to properly support fire alarm and communications cabling up to structure per the requirements of 27 0500 Common Work Results for Communications.

3.2 FINAL ACCEPTANCE

A. All project review reports ("punch-lists") submitted by the engineer shall be completed and signed by the Contractor prior to final project acceptance.

B. The Contractor shall schedule and conduct a final project review meeting with the Owner and Engineer to discuss the following items:

1. As-built drawings and documentation.
2. Test results.
3. Warranty and problem resolution procedures.
4. Special maintenance procedures.
5. Address any questions of the Owner and Engineer.

C. The Contractor shall complete all additional training for the Owner as specified in other Division 27 specification sections.

END OF SECTION

SECTION 270090 - COMMUNICATIONS DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all material, labor, services, equipment necessary to complete all demolition activities and removal of electrical and communications work indicated on the drawings or required to fulfill the intent of the construction.

B. The demolition drawings show intent and do not necessarily indicate the level of work to or existing conditions. The Contractor shall verify the details and examine the building conditions prior to bidding the project. Details that are not clear shall be referred to the Architect and Engineer for clarification prior to bidding.

C. It is the intent of this specification and accompanying drawings to describe and indicate the demolition work to be performed. It is not the intent that the specifications and drawings describe and indicate every piece of equipment required to be removed for where items are intended to be removed or as required for the satisfactory completion of the project or is considered to be the accepted practice of the trade, they shall be considered to be specified and indicated.

D. Cooperation with Contractors under separate contracts is required, and the work described herein and shown on the drawings shall be coordinated as required to fulfil the intent of the contract.

E. Related Sections include the following:

1. Division 270010 Section "General Provisions" for general conditions.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. The Contractor shall provide all equipment and materials necessary for the removal of relocation of electrical equipment.

PART 3 EXECUTION

3.1 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.2 GENERAL

A. Demolition work shall be performed in such a manner as to avoid hazards to persons and property. Work shall be performed is strict accordance with all Municipal, State and Federal Rules, Regulations, Codes and Laws which govern and apply to this work.

B. Phase all demolition activities to coordinate with the general construction and other trades schedules to minimize the downtime the Owner will experience.

C. Where communications systems and equipment is indicated to be removed or relocated, the work shall include the complete disconnection from its source, dismantling as necessary, and removal or installation of all conduit, wires, cables, etc. Unless noted otherwise, wires shall be removed from conduits back to the last utilization device or to the telecommunication room. No wiring shall be removed that prevents operation of other equipment not scheduled or indicated to be removed.

D. All electrical work in adjoining areas which is indicated on the drawings to continue to function but is affected by demolition work shall be reconnected and restored to present function as part of the electrical system of the building.

E. No portion of the communication systems may be abandoned in place. Remove all material to a previous point of usage.

F. Cut back to floor, wall, or ceiling and plug ends of concealed conduits made obsolete by alterations to permit refinishing surfaces.

G. Remove exposed conduits, wireways, outlet boxes, hangers and devices made obsolete by this work unless designated specifically to remain.

H. Provide blank plates on all unused outlet boxes.

I. The existing distribution system shall be modified as indicated on the plans and specified herein. The revised system shall be complete and continuous with all superfluous equipment and connections which are not maintained to be removed.

J. Equipment, and connections that are not intended to be demolished shall be maintained. Feeders and connections shall be protected and remain in use throughout the construction process.

K. Conduit shall be concealed within the existing building construction wherever possible, except where otherwise noted on the drawings.

L. Whenever communication materials have been removed from surfaces of the building or structure, those surfaces shall be patched and repaired.

M. All raceways which become exposed beyond finished surfaces because of the alteration work shall be removed and rerouted behind finished surfaces.

N. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

O. Alarm and emergency systems are to be interrupted only with written consent of the Owner.

P. The Electrical Contractor is to reconnect any existing circuits interrupted by demolition as required to maintain control and/or communications.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Dispose of all materials in accordance with all Federal, State, and local laws. All fees for disposal shall be borne by the electrical Contractor.

B. The Contractor shall remove all demolished equipment from the site and pay for all disposal costs with the Owner having the option to retain any removed equipment.

C. All material and debris resulting from demolition activities shall be transported and disposed of in a legal fashion and shall comply with all environmental laws.

D. Materials not noted to be reused or salvaged shall be removed from the premises and legally disposed off-site. Contractor shall not salvage material for his own benefit without written approval from Owner.

3.4 SALVAGED MATERIALS

A. All equipment noted, specified or required to be removed during demolition shall remain on the site, unless otherwise noted. The Owner reserves all rights to claiming material removed during demolition. The Contractor is responsible to remove from the site all material not claimed by the Owner. In addition, the Contractor is responsible to delivery to the Owner's storage facilities, equipment claimed by the Owner.

B. All existing materials and equipment noted, specified, or required to be salvaged and which are not scheduled to be reused, shall be carefully removed and handled to minimize damage. The Contractor shall be moved or delivered where directed by the Owner.

C. All existing material to be reused shall be carefully removed and stored in a dry location to minimize damage.

3.5 CLEANING AND REPAIR

A. All existing equipment to be reused shall be thoroughly cleaned prior to re-installation.

B. Do not remove existing racks or patch panels intended to be reused. Maintain in place or reconnect as shown on plans. Clean and provide visual inspection of all existing panels and to be reused. Provide written report of all findings to Owner.

C. Upon completion of demolition work, remove all tools, equipment, and demolished material from the site.

D. Demolition work performed in access of that required by the intended scope of the work shall be repaired and/or returned to its condition prior to the commencement of the demolition operation.

END OF SECTION

SECTION 270100 - OPERATION, MAINTENANCE & WARRANTY

PART 1 GENERAL

1.1 SUMMARY

A. This section describes the general operation, maintenance, and warranty requirements relating to all Division 27 systems.

B. This section will also cover any special training requirements the Contractor is required to provide to the Owner.

1.2 GENERAL COMMUNICATION SYSTEMS OPERATION AND MAINTENANCE REQUIREMENTS

A. All communications systems shall be demonstrated to be operation to the Owner and Engineer by documented test results and/or actual performance demonstrations of installed components. Systems shall perform at or beyond levels described in this section or other Division 27 sections.

B. Structured cabling shall perform at or beyond levels required to obtain the specified connectivity hardware manufacturer's applications assurance warranties and as required by Section 27 0800 (Commissioning and Testing of Communications Systems).

1.3 COMMUNICATION SYSTEM WARRANTIES

A. All communication systems shall include a one-year workmanship warranty from the Contractor. The workmanship warranty will start at the Substantial Completion Date which is the date mutually agreed upon by the Owner, Contractor and Architect/Engineer; A.I.A. form G704 (Certificate of Substantial Completion) will document this date. The Contractor's workmanship warranty shall provide corrective action, at no cost to the Owner and in a timely manner, for instances where products are found to be defective, poor installation practices have been discovered, specified work was found to be incomplete, or communications systems are unable to perform properly on the cabling system.

B. Extended and special manufacturer's warranties and/or service agreements will be required as described below for the following systems or system components.

1. Category 6 cabling, connectivity hardware, and patch cables shall be covered by a 20-year (minimum) application assurance warranty offered by the connectivity hardware manufacturer; this warranty shall provide coverage if the cabling system fails to perform under any of the following applications:

    a. 10BaseT, 100BaseT, or 1000BaseT.
    b. 155/622 Mbps ATM.
    c. Voice-Over-IP (analog or digital).
    d. 100 Mbps TP-TMD.
    e. Analog and Digital (Baseband/Broadband) Video.

2. The application assurance warranty shall be structured in a manner that the Contractor providing corrective services will be reimbursed by the warranty provider when the manufacturer's warranty requirements have been met. The Contractor shall register the cabling system with the connectivity hardware manufacturer to obtain the warranty from the Owner and include the approved warranty certificated in the final as-built records. The Owner will be responsible for adhering to the warranty stipulations if they should desire to continue receiving applications assurance warranty coverage.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL OPERATION, MAINTENANCE, AND WARRANTY DOCUMENTATION REQUIREMENTS

A. System operation manuals for all system components shall be provided to the Owner and included with the as-built documentation. All documentation shall be presented in 3-ring binders with all documentation hole-punched and neatly organized with index tabs.

B. Manufacturer & extended warranties for all system components shall be provide to the Owner and included with the as-built documentation. All documentation shall be presented in 3-ring binders with all documentation hole-punched and neatly organized with index tabs.

3.2 COMMUNICATIONS SYSTEM TRAINING

A. Structured cabling system training shall be review by the Contractor in a final project close-out meeting with the Engineer and Owner's representatives. The training on the structured cabling system shall include, but not limited to, the following items:

1. Review of the distribution and labeling method schemes.
2. Review of patch panel and rack layouts.
3. Review of as-built drawings and documentation.
4. Explanation of test results and data.
5. Review of Engineer's Final Project Review Report with discussion of resolutions for any outstanding items.
6. Explanation of Quality Assurance Warranties, 1-year workmanship warranty, and any other extended warranties.
7. Discussion of future problem resolution procedures.
8. The Contractor shall provide a written outline of the meeting including important contract information (i.e. phone numbers and contact personal for problem resolution).

END OF SECTION

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section describes the overall work results relating all Division 27 sections.

B. Refer to other Division 27 section for product information, installation practices, schedules, warranty, performance/testing requirements, and other system information details.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DESCRIPTION OF WORK FOR STRUCTURED CABLING SYSTEMS

A. Voice and data cabling system shall be complete, include all specified and ancillary components, be ready for use and installation of telephone and data equipment, and consist of the following criteria:

1. For the voice horizontal cabling, One (1) Category 6A cables shall be installed from rack mounted patch panels in communication rooms to each information outlet jack location as shown on the drawings. The Category 6 voice cabling shall be fully tested and documented and shall have a connectivity hardware manufacturer's quality and applications assurance warranty.
2. For the data horizontal cabling, One (1) Category 6A cables shall be installed from rack mounted patch panels in communication rooms to each information outlet jack location as shown on the drawings. The Category 6 data cabling shall be fully tested and documented and shall have a connectivity hardware manufacturer's quality and applications assurance warranty.
3. For the voice/data horizontal cabling, Two (2) Category 6A cables shall be installed from rack mounted patch panels in communication rooms to each information outlet jack location as shown on the drawings. The Category 6 data cabling shall be fully tested and documented and shall have a connectivity hardware manufacturer's quality and applications assurance warranty.
4. For the wireless access point horizontal cabling, One (1) Category 6A cable shall be installed from rack mounted patch panels in communication rooms to each wireless antenna locations as shown on the drawings. At each exterior wireless access point location, provide a Transtector #1101-994 data line surge protection device bonded to building steel. The Category 6A data cabling shall be fully tested and documented and shall have a connectivity hardware manufacturer's quality and applications assurance warranty.
5. For the CCTV camera horizontal cabling, One (1) Category 6A cable shall be installed from rack mounted patch panels in communication rooms to each camera location as shown on the drawings. Provide a 15' service loop at camera location. At each exterior CCTV camera location, provide a Transtector #1101-994 data line surge protection

device bonded to building steel. The Category 6A data cabling shall be fully tested and documented and shall have a connectivity hardware manufacturer's quality and applications assurance warranty.

6. The data backbone cable shall consist of 50/125 multi-mode and single-mode optical fiber cable main equipment room to communication rooms in a star configuration as shown on the schematic (one-line) drawings. All strands of the optical fiber cables shall be terminated in rack mounted enclosures with LC type connectors and shall be fully tested and documented.
7. Patch cords and station cords shall be furnished to the Owner (for final installation by the Owner) with quantities, types, and lengths as specified herein.

B. Other structured cabling components including racks, cabinets, enclosures, accessories, cable pathways, and grounding system will consist of the following criteria:

1. All racks, cabinets, enclosures, and accessories necessary for the structured cabling system shall be furnished and installed by the communications cabling contractor as specified herein and as shown on detail drawings.
2. Major pathways for the structured cabling system including cable trays, conduits, backbone, and conduit sleeves (2" and larger) are specified in Division 26. Cable runway in communication rooms, J-hooks for locations where structured cabling leaves cable trays, and conduit sleeves (1 ½" and smaller) are specified in this section and shall be furnished and installed by the communications cabling contractor.
3. The major components for the communications grounding and bonding system including grounding busbars in communication rooms, ground rods, and grounding conductors (larger than #2 AGW) are specified in Division 26 and schematic drawings. The communications cabling contractor shall furnishing and installing #2 AWG grounding conductors with required lugs and fasteners from all communications equipment and components to the communications grounding system.

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 4-11/16 inches wide, 4-11/16 inches high, and 2-1/2 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
2. Outlet boxes for optical-fiber cables shall be no smaller than 4-11/16 inches square by 2-1/2 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
3. Flexible metal conduit shall not be used.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway 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 the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems."
3. Terminate all conductors and optical fibers; 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.
5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
10. Support: Do not allow cables to lay on removable ceiling tiles.
11. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. UTP Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271500 "Communications Horizontal Cabling" unless otherwise indicated.

3. Do not untwist UTP cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Optical-Fiber Cable Installation:

1. Comply with TIA-568-C.3.
2. Terminate cable 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 copper cable not in a wire-way or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications 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 or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.

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 or Circuit Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

END OF SECTION

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SECTION 270526 - GROUNDING FOR COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section describes grounding and bonding requirements for all Division 27 communications systems.

B. Grounding conductors and ground rods are specified in Division 26 and as shown on detail drawings.

C. Ground busbars and accessories for communication rooms and small cabinets are additionally specified in this section.

1.2 RELATED SECTIONS

A. Sections 270010 and 270500 contain general installation practices relevant to the communications cabling systems.

B. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

1.3 GENERAL COMMUNICATIONS GOUNDING AND BONDING REQUIREMENTS

A. Communication systems grounding and bonding shall adhere to NFPA 70 (National Electric Code), J-STD- 607-A (Commercial Building Grounding and Bonding Requirements for Telecommunications), and as specified herein and as indicated on drawings.

B. All work related to the communications grounding system shall be completed by the electrical and/or communications contractors. The determinations of work responsibilities shall be coordinated between the electrical contractor(s), communication contractor(s), general contractor, and construction manager prior to bidding.

1.4 CONDUCTOR SIZES

A. The minimum conductor size for all communications grounding system shall be #2 AWG to connect equipment racks/cabinets to the ground busbar and #6 AWG to bond rack-mount components or cable sheathing to equipment racks.

B. Conductor jacket shall be green in color.

1.5 RELATED SECTIONS

A. 26 0526 Grounding and Bonding for Electrical Systems.

PART 2 PRODUCTS

2.1 MISCELLANEOUS GROUNDING EQUIPMENT

A. Horizontal rack busbar shall be installed on a minimum of one equipment rack/cabinet in each communication rooms and shall be the following requirements:

1. Constructed of 3/16" by ¾" copper alloy with eight #6-32 lugs.
2. UL Listed.
3. Approved manufacturers and product number: Chatsworth (10610-019) or equal.

B. Ground terminal block shall be installed on all racks and cabinets (when horizontal rack busbar in not installed) and shall meet the following requirements:

1. Constructed of high strength aluminum with two hole mounting attachment and stainless steel set screws.
2. Accepts #14 AWG through 2/0 conductors.
3. UL Listed.
4. Approved manufacturers and product number: Chatsworth (40167-001) or equal.

C. Clean-thread screws shall be provide for the installation ground conduction hardware on painted finishes of racks and cabinets. Clean-thread screws shall be #12-24 with a zinc finish, Chatsworth (40605-001) or equal.

D. C-type compression taps shall be used when connection two TBB copper conductors. Compression taps shall be Chatsworth (40163-0xx) or equal; sized correctly to match conductor size.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to sections 270000 and 271000 for al typical installation practices.

B. Provide grounding lugs and other accessories for a complete communications grounding systems.

3.2 COMMUNICATIONS GROUNDING CONNECTIONS

A. Mechanical compression tools shall be utilized to attach compression lugs to butt splices. Tools shall be compatible with conductor and lug sizes.

B. C-clap compression taps shall be installed utilizing a hydraulic compression tool.

C. The Division 27 Communication Contractor shall bond telecommunication equipment racks, cabinets, and ladder rack to the telecommunications grounding busbar with a #2 AWG ground wire.

END OF SECTION

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SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. This Section includes the following:

1. Communication raceway systems from the distribution and receptacle facilities.
2. Communications raceway systems shall include, but are not limited to telephone and computer/data, security and station alerting systems, etc.
3. Raceways for Division 27 shall be furnished and installed by the Division 26 Contractor.

1.2 RELATED SECTIONS:

A. Section 26 0526 “Grounding and Bonding for Electrical Systems.

B. Section 26 0533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. GRC: Galvanized Rigid Steel Conduit.

C. IMC: Intermediate Metal Conduit.

D. RNC: Rigid Nonmetallic Conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Alpha Wire Company.
4. Anamet Electrical, Inc.
5. Electri-Flex Company.
6. O-Z/Gedney; a brand of EGS Electrical Group.
7. Picoma Industries; Subsidiary of Mueller Water Products, Inc.
8. Republic Conduit.
9. Robroy Industries.
10. Southwire Company.
11. Thomas & Betts Corporation.
12. Western Tube and Conduit Corporation.
13. Wheatland Tube Company; a division of John Maneely Company.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: die cast.
b. Type: compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Arnco Corporation.
5. CANTEX Inc.
6. CertainTeed Corp.
7. Condux International, Inc.
8. Electri-Flex Company.
9. Kraloy.
10. Lamson & Sessions; Carlon Electrical Products.
11. Niedax-Kleinhuis USA, Inc.
12. RACO; a Hubbell company.
13. Thomas & Betts Corporation.

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Rigid HDPE: Comply with UL 651A.

E. Continuous HDPE: Comply with UL 651B.

F. RTRC: Comply with UL 1684A and NEMA TC 14.

G. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Solvent cements and adhesive primers 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."

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Arnco Corporation.
3. Endot Industries Inc.
4. IPEX.
5. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible-type pathway.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250,

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Moulded Products, Inc.
2. Hoffman; a Pentair company.
3. Lamson & Sessions; Carlon Electrical Products.
4. Niedax-Kleinhuis USA, Inc.

B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers 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."

2.6 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Panduit Corp.
b. Wiremold / Legrand.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Panduit Corp.
b. Wiremold / Legrand.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Panduit Corp.
b. Wiremold / Legrand.

2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. Hoffman; a Pentair company.
4. Hubbell Incorporated; Killark Division.
5. Milbank Manufacturing Co.
6. O-Z/Gedney; a brand of EGS Electrical Group.
7. RACO; a Hubbell company.
8. Robroy Industries.
9. Thomas & Betts Corporation.
10. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, cast aluminum, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Communications Device Box Dimensions: At a minimum, 4-11/16 inches by 4-11/16 inches square by 2-1/8 inches deep with single gang mud-ring or masonry extension. Use multiple gang mud-rings or extensions where required. Where boxes are installed in a firred out wall construction, a 4-11/16 inch by 4-11/16 inch box with a more shallow build may be used to accommodate firring thickness.

H. Gangable boxes are prohibited.

I. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

A. See Division 26 Specification.

PART 3 EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: IMC.
2. Concealed Conduit, Aboveground.

    a. Subject to Moisture: IMC; or RNC, Type EPC-40-PVC.
    b. Not Subjected to Moisture: EMT; IMC; or RNC, Type EPC-40-PVC.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed:

    a. Not Subject to Severe Physical Damage: EMT.
    b. Subject to Severe Physical Damage: IMC. Raceway locations include the following:

        1) Loading dock.
        2) Parking garage below 60” AFF.
        3) Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
        4) Mechanical rooms.
        5) Gymnasiums.

2. Concealed above Acoustical Tile (ACT) or Gypboard Ceilings: EMT.
3. Concealed within roofing construction or within 1-1/2" measured from the lowest surface of the roof decking: IMC or RMC.
4. 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: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size:

1. Minimum 1-inch trade size for low voltage systems.
2. Unless noted otherwise in specific sections.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all copper and optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT for pathways.
2. Use an insulated throat connector with end bushing or insulated compression coupling to terminate stub-ups not terminated in hubs or in an enclosure.

K. 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 6 inches above finished floor.
4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

L. All conduits shall be rigidly installed, adequately supported and properly reamed at both ends. Conduit types and installation methods shall be as specified elsewhere unless indicated otherwise.

M. Terminate metallic conduits using insulated metallic bushings. Bushings shall be installed prior to the pulling of any wires.

N. The conduits shall be run in the shortest straight runs wherever possible. No section of conduit runs shall be longer than 100 feet or contain more than two 90 degree bends. (A double offset is equal to one 90 degree bend.).

O. For sections of conduit runs longer than 100'-0", or containing more than two 90 degree bends, or containing a reverse bend, pull boxes shall be provided.

P. Bends in conduits, and in particular conduits larger than 2", shall be long sweep radius bends wherever possible. In no instance shall the inside radius of the bend be less than:

1. Six (6) times the internal diameter for conduits 2" and smaller.
2. Ten (10) times the internal diameter for conduits 2 1/2" and larger.

Q. Conduits entering communications closets shall have grounding bushings and shall terminate as close as possible near the wall through which the conduits enter. Bond to nearest telecommunications grounding bus.

R. All conduits shall be left clean, dry and free of debris and other obstructions.

S. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

T. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

U. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

V. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

W. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

X. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

Y. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 36 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Z. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

AA. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway 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.

BB. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

CC. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

DD. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

EE. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

FF. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a rain-tight connection between box and cover plate or supported equipment and box.

GG. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

HH. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

II. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

JJ. Set metal floor boxes level and flush with finished floor surface.

KK. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

END OF SECTION

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SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.2 RELATED SECTIONS:

A. Section 078413 "Penetration Fire-stopping" for penetration fire-stopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
4. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install 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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers the identification and labeling for all Division 27 communications systems.

B. Identification and labeling for communications shall conform to ANSI/TIA/EIA 606 standards, labeling requirements specified herein and as indicated on detail drawings.

1.2 SUBMITTALS

A. Included with the shop drawing submittals, the Contractor shall provided a sample of all label types and labeling methods planned for use on the project. The labeling sample submittal shall include the following items:

1. Labels attached to an 8½x11 sheet of paper with a written description of each label and the intended use for each label.
2. Provide one sample of custom style faceplates including engraved labeling.
3. Indicate the labeling method and labeling scheme intended for identifying both end of cables (on cabling sheathing).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Labels shall be machine generated (unless other methods are specifically indicated) and shall be made with the Brady TLS 2200 thermal labeling system or other approved labeling system. Labels shall be a permanent polyester material clear in color (or color matching/near color of material affixed to label) with label lettering black in color (or of a contracting color; i.e., white letters on black label when label is placed on black surface).

B. Surfaces shall be cleaned before attaching labels. All labels shall be attached firmly and vertically plumb on equipment, faceplates, patch panels, termination blocks, etc.

C. The Engineer and Owner shall approve the Labeling scheme prior to the installation of any cabling.

D. All labeling of cables, equipment, and components shall be included in as-built documentation, floor plan drawings, and schematic diagrams.

3.2 LABELING OF CABLES

A. All structured cables (horizontal and backbone) shall be labeled at both ends within 3" of cable termination point. Where voice backbone cables extend behind termination blocks, cable labels shall be places at a location on the cable where the labels are visible from the front of the termination blocks.

B. Labels shall be have an adhesive backing and shall wrap completely around the circumference of the cable sheathing. Label and lettering sizes shall be of appropriate size for the varying cable sizes.

3.3 LABELING OF EQUIPMENT RACKS AND TERMINATION HARDWARE

A. All communications equipment racks, cabinets, and termination hardware shall be clearly labeled at the top, left-hand corner of the equipment.

B. Equipment Racks and Cabinets shall have 3/4" to 1" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character in sequence for each rack/cabinet (i.e., TR2-A represents the first rack/cabinet in Telecommunications Room #2).

C. Modular Patch Panels shall have 3/8" to 1/2" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the patch panel number (i.e., TR3-C-2 represents the second patch panel, third rack/cabinet in Telecommunications Room #3). Additionally, each jack position on the patch panel shall be identified with the jack position number (i.e., a 48-port patch panel shall have number 1 through 48 silk screen printed on the patch panel or shall have labeling strips with numbers 1 through 48 machine printed above/below corresponding jack position).

D. Modular Patch Panels shall have 3/8" to 1/2" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the patch panel number (i.e., TR3-C-2 represents the second patch panel, third rack/cabinet in Telecommunications Room #3). Additionally, each jack position on the patch panel shall be identified with the jack position number (i.e., a 48-port patch panel shall have number 1 through 48 silk screen printed on the patch panel or shall have labeling strips with numbers 1 through 48 machine printed above/below corresponding jack position).

E. Voice Termination Blocks shall be labeled similar to patch panels and fiber enclosures when installed in equipment racks and cabinets. Voice backbone cable pairs shall be labeled starting with V001 starting at the main communications room and continuing sequentially through all communication rooms. Horizontal voice cables (station cables) terminated on 110-style blocks shall be labeled similar to data patch panels (i.e., TR1-V12 would indicate the jack is located in Telecommunications Room #1 and is jack position #12 on the termination block).

3.4 LABELING OF FACEPLATES

A. Voice and Data Outlets shall have 3/16" high lettering with the labeling method as indicated in Specifications Section 27 1543 and on detail drawings. Voice and data outlets shall be identified with the telecommunication room where cables are terminated, the rack/cabinet number, the patch panel number, and the jack position number (i.e., TR3-C-2-28 represents the outlet is located on the second patch panel in the third rack/cabinet in Telecommunications Room #3 and is jack position #28). The contractor shall terminate all cabling in a sequential method.

END OF SECTION

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SECTION 270600 - SCHEDULES FOR COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section provides an overview of the communication work schedules for the Division 27 sections on the new Faribault County Justice Center located in Blue Earth, Minnesota.

1.2 GENERAL WORK SCHEDULE REQUIREMENTS

A. All communications work shall be coordination with the general construction and general contractor/project manager. Refer to Division 1 - General Requirements, Bidding Requirements, and Condition of the Contract for specific information regarding the project schedule, including any penalties imposed for not meeting completion dates; information contained on the general and Division 1 Sections shall superseded schedule information in this section.

B. The Communications Contractor(s) shall attend construction meetings on a regular basis, as required, by the construction project manager to obtain on-going construction schedule progress updates and to provide communication systems scheduling updates and work coordination with other trades.

C. Construction schedule are subject to change due to unforeseen circumstances. The Communications Contractor(s) shall be required to adjust work schedule accordingly.

D. No communication systems work shall commence on-site and no equipment shall be ordered prior the successfully completion and execution of the following items:

1. Owner/Contractor Agreement (Contract).
2. Insurance Certificates.
3. Permits and licenses (as required).
4. Shop Drawings (with “No Exceptions Take” notification from Engineer).
5. Other documentation requirement of General Condition.

1.3 COMMUNICATION SYSTEM SCHEDULES

A. Structured Cabling work shall be substantial complete in accordance with the general construction schedule.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 270800 - TESTING OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers commissioning, contractor testing, and test result documentation for all Division 27 communications systems.

B. The communications systems in Division 27 will not require commissioning by an independent commissioning specialist. All communications systems shall be tested and documented by the contractor installing each system as specified herein.

C. The Engineer and/or Owner will request witness testing of up to 5% of the cable runs for any communication cabling system prior to substation completion of the project. This testing shall be provided by the Contractor.

1.2 OVERVIEW OF COMMUNICATION SYSTEMS TESTING REQUIREMENTS

A. Structured Cabling System testing shall be completed for all segments of the structured cabling systems including Category 6 horizontal cabling, copper backbone cabling, optical fiber cabling, and coaxial cabling. All cables shall be tested and documented as specified herein.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall notify the Engineer a minimum of one week prior to any testing and shall provide a testing schedule prior to the testing of cabling and equipment. Owner’s representatives and the Engineer may be in attendance to witness the test procedures. The Contractor shall re-schedule testing as necessary to accommodate the schedules of the Owner/Engineer for any testing the Owner/Engineer may want to witness.

B. All cable runs shall be tested. Any segment with failing or receiving marginal test results shall be evaluated and receive corrective action. Cable runs continuing to fail test results should be evaluated with the Engineer and shall be replaced when necessary to obtain passing test results.

C. All cable runs must receive passing test results prior to final acceptance of the project.

D. All test results shall be documented and included with contractor’s final as-built documentation and will be review by the Engineer prior to final acceptance and closeout of the project.

E. The test equipment manufacturer shall calibrate all test equipment at regular intervals as recommended by the manufacturer. Calibration reports shall be provided to the Engineer upon request.

F. Technicians who have completed an appropriate training course for the use of specified test equipment shall conduct all testing.

3.2 CATEGORY 6 HORIZONTAL CABLE TESTING

A. All Category 6 horizontal cable runs shall be tested with a Level III tester capable of testing 4-pair UTP cable frequencies from 1.0-250 MHz. The Contractor shall use on of the following testers: Agilent Wirescope 350, Fluke DSP-4000, or Ideal LanTek 7.

B. All Category 6A horizontal cable runs shall be tested with a Level III tester capable of testing 4-pair UTP cable frequencies from 1.0-500 MHz. The Contractor shall use on of the following testers: Agilent Wirescope 350, Fluke DSP-4000, or Ideal LanTek 7.

C. Category 6 and 6A cabling shall include the following tests:

1. Wire Map.
2. Length.
3. Attenuation (insertion loss).
4. NEXT (near end cross talk-to be performed on all Category 6 cables BI-directionally).
5. Power Sum PSNEXT.
6. Pair to pair ACR-F (equal level far end cross-talk).
7. Power Sum PSACR-F.
8. Return Loss.
9. Propagation Delay.
10. Delay Skew.

D. Permanent Link testing shall be performed and shall conform to the following test result parameters defined by ANSI/EIA/TIA 568-C.2 for Category 6 and 6A. Minimum test results are listed in the tables below.

Category 6						
Frequency MHz	Insertion Loss	NEXT	PSNEXT	ACR-F	PSACR-F	Return Loss
1.0	2.1	65.0	62.0	63.3	60.3	19.0
4.0 8.0	4.0 5.7	63.0 58.2	60.5 55.6	52.1 45.2	48.2 42.2	19.0 19.0
10.0	6.3	56.6	54.0	43.3	40.3	19.0
16.0	8.0	53.2	50.6	39.2	36.2	18.0
20.0	9.0	51.6	49.0	37.2	34.2	17.5
31.25 62.50	11.4 16.5	48.4 43.4	47.3 40.6	33.4 27.3	30.4 24.3	16.5 14.0
100.0	21.3	39.9	37.1	23.3	20.3	12.0
200.0	31.5	34.8	31.9	17.2	14.2	9.0
250.0 300.0 400.0 500.0	35.9 --- --- ---	33.1 --- --- ---	30.2 --- --- ---	15.3 --- --- ---	12.3 --- --- ---	8.0 --- --- ---

All values are measured in (dB.) per 100m (328 feet) length @20C.
Delay skew shall not exceed 45.0 ns/100m.
Propagation delay at 10 MHz shall not exceed 545.0 ns/100m.
Propagation delay at 250 MHz shall not exceed 536.0 ns/100m.

Category 6A						
Frequency MHz	Insertion Loss	NEXT	PSNEXT	ACR-F	PSACR-F	Return Loss
1.0	2.3	65.0	62.0	63.3	60.3	19.0
4.0 8.0	4.2 5.8	63.0 58.2	60.5 55.6	52.1 45.2	48.2 42.2	19.0 19.0
10.0	6.5	56.6	54.0	43.3	40.3	19.0
16.0	8.2	53.2	50.6	39.2	36.2	18.0
20.0	9.2	51.6	49.0	37.2	34.2	17.5
31.25 62.50	11.5 16.4	48.4 43.4	47.3 40.6	33.4 27.3	30.4 24.3	16.5 14.0
100.0	20.9	39.9	37.1	23.3	20.3	12.0
200.0	30.1	34.8	31.9	17.2	14.2	9.0
250.0 300.0 400.0 500.0	33.9 37.4 43.7 49.3	33.1 31.7 28.7 26.1	30.2 28.8 25.8 23.2	15.3 13.7 11.2 9.3	12.3 10.7 8.2 6.3	8.0 7.2 6.0 6.0
All values are measured in (dB.) per 100m (328 feet) length @20C. Delay skew shall not exceed 45.0 ns/100m. Propagation delay at 10 MHz shall not exceed 545.0 ns/100m. Propagation delay at 250 MHz shall not exceed 536.0 ns/100m.						

E. In addition to 100% of the cables passing all Permanent Link test parameters, the contractor is required to provide a manufacturer's warranty covering the Channel Link (including patch cords/station cords). Refer to Section 27 0100 for more information on manufacturer's warranty requirements.

F. Test results (in summary format) shall be printed and bound in a 3-ring binder. Provide two copies of the printed test results with the as-built documentation submittal. In addition to the printed test results, the Contract shall provide the detailed electronic test results (on compact disk) and a copy of the test manufacturer's software to view the test results with the as-built documentation submittal. The test equipment manufacturer's software can be provided on CD or can be instructions on how to download the software (free of charge).

3.3 OPTICAL FIBER CABLING TESTING

A. All strands of all optical fiber cables shall be field-tested (unless specifically noted on drawings as un-terminated strands for future use). Field test equipment and testing methods for multimode optical fiber cable shall meet the requirements of ANSI/EIA/TIA-526-14A;

single-mode field test equipment and methods shall meet the requirements of ANSI/EIA/TIA-526-1. Optical fiber cabling testing shall adhere to the following criteria:

1. Building backbone cabling (multimode and single mode) and any workstation horizontal fiber cabling shall be tested with a power loss meter for insertion loss (Link Attenuation) in both directions and at both operating wavelengths.
2. Test equipment shall measure the length and automatically calculate the link loss based on ANSI/EIA/TIA-568-B.1 standard loss values; all links shall receive a PASS value.

B. Test results, including distances and insertion loss readings shall be printed and bound in a 3-ring binder. Provide two copies of the printed test results with the as-built documentation submittal.

END OF SECTION

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SECTION 271000 - STRUCTURED CABLING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers general installation practices for all Division 27 1000 series communications cabling and equipment products.

B. All work specified under Division 27 1000 series sections shall follow installation practices described herein and all guidelines as established by the following codes and standards:

1. ANSI/EIA/TIA-568-B.1 (Commercial Building Telecommunications Cabling Standard - General Requirements).
2. ANSI/EIA/TIA-568-B.2 (Commercial Building Telecommunications Cabling Standard - Balanced Twisted-Pair).
3. ANSI/EIA/TIA-568-B.3 (Optical Fiber Cabling Components Standard).
4. ANSI/NECA/BICSI-568 (Standard for Installing Commercial Building Telecommunications Cabling).
5. NFPA 70 (National Electrical Code).
6. OSHA Regulations.
7. All addenda to the codes, standards, and regulations lists above shall be applicable.

1.2 OVERVIEW OF STRUCTURED CABLING WORK

A. The structured cabling work includes all cabling and components required for the voice, data, CATV communications systems at the facility.

1.3 DRAWINGS

A. It shall be understood that the electrical and communication details and drawings provided with the bid documents are diagrammatic. They are included to show intent and to aid the Contractor in bidding the job. The Contractor shall make allowance in their bid to cover whatever work is required to comply with the intent of the plans and specifications.

B. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. All cable, equipment, and components shall be installed in accordance with manufacturer’s written instructions, in compliance with NEC, and in accordance with industry standard practices.

B. All equipment shall be installed in a neat, professional manner, always vertically plumb and securely fastened.

C. Equipment and cable colors shall be consistent throughout the entire project unless specifically noted otherwise. In example, if horizontal data UTP cable is specified as blue, then blue cable shall be used throughout the entire project; or, if equipment racks are specified as black, then black racks, black rack mounting screws, and black cable mangers shall be used throughout the entire project.

D. All equipment racks/cabinets, cable tray, cable runways, and metallic sheathing on cables shall be bonded and grounded to the communications grounding system; refer to Section 27 0526 (Grounding and Bonding for Communications Systems) for more information.

E. All equipment, cabling, and terminations shall be labeled; refer to Section 27 0553 (Identification of Communications Systems) for more information.

F. All communications cabling that has become abandoned as part of new renovation projects, previous renovation projects, or temporary communication cables used during the construction process shall be completely removed. Abandoned communication cables that may have future use can remain in place if labeled clear at both end and at regular intervals of the cable run. Refer to NEC Article 800.52 for more information regarding the removal of abandoned communication cables.

G. Cables installed in return air plenum ceiling spaces shall be plenum rated; cables installed in below grade pathways shall have water blocking capabilities and rated for use in below grade applications.

H. The communications cabling contractor shall provide approved fire-stopping materials in and around any opening created for communications cabling where code or good installation practices suggests or requires fire-stopping materials.

3.2 CABLING INSTALLATION PRACTICES

A. All cabling shall be installed in accordance with manufacturers' written bend radius and pulling tensions. General industry guidelines recommend the following bend radius and pulling tensions:

1. Tensile loading on a single 4-pair copper UTP cable shall not exceed 25 lbf.
2. Bend radius of a single 4-pair copper UTP cable shall not exceed 4 times the diameter of the cable.
3. Bend radius of multi-pair copper UTP and optical fiber cable shall not exceed 10 times the diameter of the cable.

B. All conduits and conduit sleeves shall have bushings or grommets shall be installed prior to the installation of communications cables to avoid damage and abrasions to cable sheathing and insulation. If bushings have are installed by the electrical contractor, the communications cabling contract shall furnish and install bushings prior to pulling communications cabling.

C. Horizontal cable length for 4-pair copper UTP cables shall not exceed 295 feet. Prior to bidding and installation, the contactor shall review the drawings and verify no cable run

exceeds 295 feet and notify the communications designer of cable runs that may exceed 295 feet.

D. Splices are not permitted in any voice or data cable unless other specified or show on drawings.

E. Avoid placing copper cables near sources of extreme heat (i.e., boilers, radiators, heat coils).

F. Maintaining cable twists for all UTP cables. For terminations cable sheathing shall be stripping back no more than ½" back from termination point for all Category and Category 6A cables.

G. All cables shall be supported by cable tray, cable runway, or J-hooks. When large quantities of cables leave trays or runways, cables shall be supported by drop-outs or cable support hardware manufactured specifically for the purpose of supporting cables. J-hooks shall be installed a minimum of every 5 feet and cabling shall maintain minimal deflection and strain (less than 12" deflection).

H. Cables shall not be supported from ceiling grid wires.

I. Cables shall not run above or through webbing of iron joists.

J. All cables shall be separated and bundled into like groups by cable sheathing colors.

K. Service loops shall be provided at both ends of installed horizontal and backbone cabling. A 12' (foot) service loop shall be installed in the ceiling space near workstation outlets (excessive cable shall not be coiled in outlet boxes). A 12' (foot) service loop shall be provided in communication rooms and shall be installed to allow for future equipment rack/cabinet relocations without the need to re-terminate patch panels; the 12' (foot) service loop shall be neatly bundled and secured in ceiling space with large D-rings or place in cable trays.

L. Any cabling installing in equipment rooms shall be neatly placed in cabling trays, cabling runways, or horizontal and vertical rack/cabinet cable managers. When tray, runways, or cable managers are not specified, cable shall be neatly installed with D-rings. Cables shall always be installed vertically/horizontally or at right angles to structure.

M. Nylon plastic cable ties may be used to secure permanently installed horizontal and backbone cabling; any cable ties installed in plenum ceiling spaces shall be rated for use in plenum spaces. Cable ties shall never be secured too tight whereby potentially changing the cable geometry.

END OF SECTION

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SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

1.2 RELATED SECTIONS:

A. Sections 270000 and 271000 contain general installation practices relevant to cabinets, racks, frames, and enclosures.

B. Section 270553 contains information regarding the labeling of equipment.

C. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

D. RU: Rack Unit.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. 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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

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 or Commercial Installer, Level 2.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or 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 or Commercial Installer, Level 2 to perform the on-site inspection.

PART 2 PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches, A/C grade. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

B. Install ‘A’ grade side of plywood to the room side, rough side shall face the wall.

2.2 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. Belden Inc.
3. Cooper B-Line.
4. Emerson Network Power Connectivity Solutions.
5. Hubbell Premise Wiring.
6. Leviton Commercial Networks Division.
7. Middle Atlantic Products, Inc.
8. Ortronics, Inc.
9. Panduit Corp.
10. Siemon Co. (The).
11. Tyco Electronics Corporation; AMP Products.

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-D standard, 19-inch 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 a 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. Rack-mounted, 550-cfm fan with filter.
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

E. 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.

2.3 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. Close-coupled, direct plug-in line cord.

9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

2.4 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.5 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 GENERAL

A. Refer to Project Drawings that indicate Equipment Room layout.

B. Furnish and install hardware and equipment as shown on drawings and as specified.

C. It is the contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

D. Beginning installation means contractor accepts existing conditions.

E. Should it be found by the Engineer that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and drawings with the respect or regard to the quality, value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

F. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

G. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner 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 telephone switch and LAN 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.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch 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.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 271116 - CABINETS, RACKS, FRAMES & ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

A. This section covers communications cabinets, racks, frames, and enclosures for all Division 27 cabling and equipment components.

B. Other systems (communications, electronic safety, and security) may utilize portions of the cabinet, rack, and enclosure spaces specified herein. Other system may also include additional cabinets, racks, and/or enclosures included in other specification sections.

C. Unless otherwise indicated in the specifications, quantities for cabinets, racks, frames, and enclosures shall be as indicated on the drawings.

1.2 RELATED SECTIONS

A. Sections 270000 and 271000 contain general installation practices relevant to cabinets, racks, frames, and enclosures.

B. Section 270553 contains information regarding the labeling of equipment.

C. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

D. Sections 271123 and 271126 specify cabling management and power supply products utilized in conjunction with cabinets, racks, frames, and enclosures.

PART 2 PRODUCTS

2.1 RACKS

A. Floor Mounted 2-post Open-Frame Racks shall comply with the following requirements:

1. 84" in height equipped with 45 rack 1.75" rack mounting spaces.
2. 19" wide rack mounting rails with 3" with channels.
3. EIA-310-D compliant mounting channels; accepts #12-24 mounting screws on front and back of channel. Provide minimum 200 units of M6 cage nuts with #12-24 thread and equal quantity of #12-24 spare screws.
4. Constructed of structural grade aluminum with black finish.
5. Manufacturer must have published static load rating of 750 pounds or greater (evenly distributed).
6. Provisions for supporting and attaching cable runway and cable management.
7. Mounting holes for anchoring rack to floor.
8. Equipped with grounding lug.
9. UL Listed.
10. Approved manufactures and part numbers: Ortronics (OR-19-84-T2SD-CMB).

2.2 OPTICAL FIBER ENCLOSURES

A. Optical Fiber Rack-Mount Enclosures shall comply with the following requirements:

1. Equipped with fanning guides and retainer strips to protect cables and maintain bend radius control.
2. Equipped with fully retractable top and removable front cover.
3. Designed for rack mounting in standard 19” or 23” racks or cabinets.
4. Include vertical cable management rings and all accessory cable routing and labeling kits.
5. Equipped with ST-style adapter modules and blank filler panels in quantities as required.
6. 144 fiber ST-style connectors shall occupy not more than 5 rack units (including pigtail splice enclosure if pigtails are utilized).
7. Approved manufacturers: ADC (FL2000), Corning (CCH-xxx), or Systimax (600G2).

2.3 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
2. Rack-Mounted Horizontal TGB: Designed for mounting in 19” equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical TGB: 72” long, with stainless-steel or copper-plated hardware for attachment to rack.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Sections 27 0000 and 27 1000 for all typical installation practices.

3.2 CABINET AND RACK INSTALLATION PRACTICES

A. Always follow manufacturer’s installation instructions.

B. Working clearances around equipment for final placement of all cabinets, racks, frames, and enclosures shall comply with all industry codes and standards. Always verify final equipment placement with the Engineer prior to the installation anytime doubt or confusion may arise.

C. Cabinets equipment with leveling feet shall be install level and secure. Cabinet equipment with caster shall be locked.

D. Open frame racks shall be securely anchored/bolted to the floor.

E. Damaged equipment including dented panels, twisted frames, scratches through painted metal surfaces, and inoperable door hardware shall be replaced or repaired to the satisfaction of the Owner and Engineer.

F. Furnish and Install all accessories necessary to provide a complete structured cabling system.

G. Where cable runways are shown on drawings above equipment racks and cabinets, securely attach to cable runway to racks and cabinets with bolt assembly.

H. Where wall-mounted rack and enclosures are installed at locations without plywood backboards, racks and enclosures shall be securely attached to stud walls or plywood backing shall be furnished and installed for additional support and distribution of the load as required. Provide ¾" plywood backboards as required or as noted on drawings with two coat of fire retardant grey paint on all sides of the plywood.

3.3 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

D. Bond rack or enclosure to TGB or TMGB.

END OF SECTION

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SECTION 271119 - TERMINATION BLOCKS & PATCH PANELS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers termination blocks and patch panels utilized for all Division 27 sections.

B. Quantities for all communications termination equipment shall be provided as required to terminate all outlet locations and cabling as shown on floor plans and riser diagrams plus 20% spare (future) capacity.

1.2 RELATED SECTIONS

A. Sections 270010 and 270500 contain general installation practices relevant to the communications cabling systems.

B. Section 270553 contains information regarding the labeling of termination blocks and patch panels.

C. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

PART 2 PRODUCTS

2.1 VOICE AND DATA PATCH PANELS

A. Category 6 Patch Panels shall be utilized for voice/data cabling and shall comply with the following requirements:

1. TIA/EIA Category 6 compliant.
2. Angled design.
3. 8-position/8-conductor modular connector.
4. Support T568A/B universal wiring schemes.
5. 19" rack mountable, black in color.
6. Accept 110-type termination tool.
7. 24 connectors in 1 rack unit or 48 connectors in 2 rack units.
8. Include front labeling, clear plastic holders for laser printed labels.
9. Approved manufacturers: Commscope, Leviton, Panduit, Ortronics, Seimon, or Systimax.

B. Fiber Optic Cable Patch Panels shall comply with the following requirements:

1. TIA/EIA Fiber cable compliant.
2. Match the type of fiber cable being used and number of strands.
3. 19" rack mountable, black in color.
4. Front and rear removable doors, removable top, large front mounted fiber guides and integrated hinged optical jumper manager.

5. Provide full complement of blank adapter panels, labels, cable storage accessories and cable routing accessory kit.
6. Provide connector panels and connectors as indicted for the fiber.
7. 24 connectors in 1 rack unit or 48 connectors in 2 rack units.
8. Multi-mode connector panels shall be color coded according to the fiber type for which they are applied. Laser optimized 50/125 micron multimode shall be aqua.
9. Include front labeling, clear plastic holders for laser printed labels.
10. Approved manufacturers: Commscope, Leviton, Panduit, Ortronics, Seimon, or Systimax.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Sections 270000 and 271000 for all typical installation practices.

3.2 TERMINATION BLOCK AND PATCH PANEL INSTALLATION PRACTICES

A. Securely attach all termination blocks and patch panels to rack/cabinet mounting rails (or plywood backboards for wall mounted termination blocks) with appropriate mounting hardware at all four corners for all blocks and panels.

B. All cabling terminated to blocks and patch panels can be neatly secured in place with tie-raps (or removable straps). Provide metal D-Rings or other approved support method for securing vertically routed cable; support at intervals less than four feet in length to limit strain and movement of cabling.

END OF SECTION

SECTION 271126 - RACK MOUNTED POWER PROTECTION & POWER STRIPS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers communications rack and cabinet mounted power strips, power supplies, and power protection devices for all Division 27 sections.

B. Unless otherwise indicated in the specifications, quantities for rack and cabinet mounted power devices shall be as indicated on the detail drawings.

1.2 RELATED SECTIONS

A. Sections 270000 and 271000 contain general installation practices relevant to the communications cabling systems.

B. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

PART 2 PRODUCTS

2.1 POWER STRIPS

A. Rack-Mounted Power Strips shall be provided on all open-frame racks and shall comply with the following requirements:

1. Rack mounted (vertically).
2. Include mounting hardware with 6.5" standoff compatible with EIA standard rack.
3. 60" to 67" in length.
4. Single 20 amp circuits with 20 NEMA 5-15R receptacles.
5. Input power cord with NEMA L5-20P plug.
6. Black in color.
7. UL Listed.
8. No surge protection or circuit breaker.
9. Approved manufacturers and model: Chatsworth 12851-724 or equal.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Sections 270000 and 271000 for all typical installation practices.

3.2 POWER STRIP INSTALLATION

A. Securely attach one power strip to each open-frame rack with appropriate mounting hardware.

B. Power cords shall be neatly fastened to racks and cabinet with tie-raps or reusable straps. Excess power cord shall be neatly coiled and tie-rapped.

C. Avoid placing power supply devices and power cords near communications cabling as much as possible. Ideally, power supply devices and power cords and be installed on one side of the rack/cabinet with communications cabling routed on the other side.

END OF SECTION

SECTION 271323 - OPTICAL FIBER BACK-BONE CABLING

PART 1 GENERAL

1.1 SUMMARY

A. This section covers optical fiber cabling utilized by Division 27 systems and possibly other intelligent building systems specified by other Divisions.

B. Quantities and strand count for optical fiber backbone cabling shall be provided as shown on the drawing schematic diagrams.

1.2 RELATED SECTIONS

A. Sections 270010 and 270500 contain general installation practices relevant to the communications cabling systems.

B. Section 270553 contains information regarding the labeling of backbone cabling.

C. Section 270100 contains important information regarding manufacturer’s warranties for the voice and data cabling systems.

1.3 REFERENCES

A. ANSI/TIA-568-C - Commercial Building Telecommunications Wiring Standard.

B. ANSI/TIA-758-A - Customer Owned Outside Plant Telecommunications Infrastructure Standard.

C. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM) current edition.

D. National Electrical Code (NEC) based on year approval by local codes or AHJ.

E. Local, County, State and Federal regulations and Codes in effect.

1.4 SUBMITTALS

A. Refer to 270010.

1.5 QUALITY ASSURANCE

A. Refer to 270010.

B. Cable installation Contractor shall have a minimum of five years installation experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to section 270010.

B. Storage temperature range: -40°F to 149°F (-40°C to 65°C).

C. The fiber optic cable shall be shipped on reels in lengths as required by the project.

1. The cable shall be wound on the reel so that unwinding can be done without kinking the cable.
2. Two meters of cable at both ends of the cable shall be accessible for testing. All optical fiber shall be tested on the reel for continuity and distance compliance before installation.
3. Marking: Each reel shall have a permanent label attached showing length, cable identification number, cable size, cable type, attenuation, bandwidth, and date of manufacture. Labels shall be water resistant and the writing on the labels shall be indelible.

1.7 PROJECT/SITE CONDITIONS

A. Refer to section 270010.

1.8 WARRANTY

A. Refer to section 270010.

1.9 MAINTENANCE AND SUPPORT

A. Refer to section 270010.

PART 2 PRODUCTS

2.1 OPTICAL FIBER BACKBONE CABLING

A. 50/125µm Multi-Mode Optical Fiber Cable shall comply with the following requirements:

1. Laser-optimized for 300 meter 10 Gbps applications (IEEE 802.3ae).
2. Guarantee the following Ethernet transmission performances:

a. Fast Ethernet (100 Mbps) - 300m @ 850nm; 2km @ 1300nm.
b. Gigabit Ethernet (1 Gbps) - 900m @ 850nm; 550m @ 1300nm.
c. 10 Gigabit Ethernet (10 Gbps) - 300m @ 850nm; 300m @ 1300nm.

3. 900µm PVC buffered with industry standard color coding (1-blue, 2-orange, 3-green, 4-brown, 5-slate, 6-white, 7-red, 8-black, 9-yellow, 10-violet, 11-rose, 12-aqua).
4. Maximum attenuation of 3.5dB/km @ 850nm and 1.5dB/km @ 1300nm.
5. Plenum rated, UL Listed type OFNP marking on cable.
6. Product identifications and cable distance markings at regular intervals on cable.
7. Aqua-blue in color (outer cable jacket).

8. Central dielectric strength member and KEVLAR© strength member lining outer jacket.
9. Operating temperature range: -40°F to 158°F (-40°C to 70°C).
10. Normal product in inventory of local distributor.
11. ISO 9001 certified manufacturer.
12. Approved manufacturers and product number: ADC (6024PTHCBC50U), Corning (024S88-33180-29), Systimax (5201 024A ZPAQ).

B. Single-Mode Optical Fiber Cable shall comply with the following requirements:

1. Guarantee the following Ethernet transmission performances:

    a. Fast Ethernet (100 Mbps) - 2km @ 1310nm.
    b. Gigabit Ethernet (1 Gbps) - 5km @ 1310nm.
    c. 10 Gigabit Ethernet (10 Gbps) - 10km @ 1310nm; 40km @ 1550nm.

2. 245µm or 900µm PVC buffered with industry standard color coding (1-blue, 2-orange, 3-green, 4-brown, 5-slate, 6-white, 7-red, 8-black, 9-yellow, 10-violet, 11-rose, 12-aqua).
3. Maximum attenuation of 0.4dB/km @ 1310nm and 0.3dB/km @ 1550nm.
4. Plenum rated, UL Listed type OFNP marking on cable.
5. Product identifications and cable distance markings at regular intervals on cable.
6. Yellow in color (outer cable jacket).
7. Central dielectric strength member and KEVLAR© strength member lining outer jacket.
8. Operating temperature range: -40°F to 158°F (-40°C to 70°C).
9. Normal product in inventory of local distributor.
10. ISO 9001 certified manufacturer.
11. Approved manufacturers and product number: ADC (6012PTHCBC010), Corning (012R88-33131-29), Systimax (5201 012A WPYL).

C. 62.5µm Multi-Mode Indoor/Outdoor Rated Optical Fiber Cable shall comply with the following requirements:

1. Guarantee the following Ethernet transmission performances:

    a. Fast Ethernet (100 Mbps) - 2km @ 1310nm.
    b. Gigabit Ethernet (1 Gbps) - 2km @ 1310nm.

2. 900µm PVC buffered with industry standard color coding (1-blue, 2-orange, 3-green, 4-brown, 5-slate, 6-white, 7-red, 8-black, 9-yellow, 10-violet, 11-rose, 12-aqua).
3. Maximum attenuation of 1.0dB/km @ 1310nm and 1.0dB/km @ 1550nm.
4. Plenum rated, UL Listed type OFNP marking on cable.
5. Product identifications and cable distance markings at regular intervals on cable.
6. Central dielectric strength member and KEVLAR© strength member lining outer jacket.
7. 2-strand optical fiber cable.
8. Operating temperature range: -40°F to 158°F (-40°C to 70°C).
9. Normal product in inventory of local distributor.
10. ISO 9001 certified manufacturer.
11. Approved manufacturers and product number: Corning FREEDM®, Systimax (5101 002A MPBK), or prior approved equal.

2.2 OPTICAL FIBER CABLE TERMINATING CONNECTORS

A. Optical Fiber Connectors shall be st-type and shall comply with the following requirements:

1. Comply with ANSI/TIA/EIA 568-B.3.
2. Ceramic ferrules utilizing adhesive for connection to ferrule.
3. Designed for multimode 50/125µm and single mode fiber.
4. Typical insertion loss of 0.2dB.
5. Approved manufacturers: ADC, Corning, or Systimax.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Sections 270000 and 271000 for all typical installation practices.

B. All backbone cabling shall be labeled on cable sheathing and at terminations in enclosures; refer to Section 270553.

3.2 OPTICAL FIBER BACKBONE CABLING INSTALLATION PRACTICES

A. The same manufacturer's product shall be utilized throughout the entire project for all optical fiber backbone cabling.

B. All strands of optical fiber backbone cables shall be terminated at both ends in enclosures.

C. Optical fiber backbone cables shall be installed in cable runways and cable tray systems in such a manner to avoid crushing or cable deformation by other cables. Where optical fiber backbone cables are not installed in runway/tray support systems, optical fiber backbone cables shall be installed in innerduct and supported at regular intervals. Refer to Section 270543 for additional information on innerduct product and installation.

D. Splicing of optical fiber backbone cables is only permitted in communication room enclosures for manufacture approved pigtail connectors, at splice enclosures identified on the drawings, or for other special situations with prior approval from the Engineer.

E. Where splices are permitted, fusion or mechanical splicing methods are acceptable. Maximum insertion loss of any splice shall not exceed 0.3 dB with typical losses of 0.1- 0.2 dB observed in test results. Contractor may be required to re-splice cable if losses are higher than 0.2dB and the to fiber segment loss budgets are excessive.

F. A maximum connector insertion loss of 0.75dB is permitted by industry standards; however, typical insertion losses of 0.2dB shall be observed in test results. Contractor may be required to re-terminate connectors if losses are higher than 0.3dB and the to fiber segment loss budgets are excessive.

END OF SECTION

SECTION 271513 - COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.1 SUMMARY

A. This section covers copper horizontal cabling utilized by all Division 27 systems and possibly other intelligent building systems specified by other Divisions.

B. Quantities for all copper horizontal cabling shall be provided as required to complete cabling to all outlets as shown on the floor plans.

C. Horizontal copper cabling are those cable routed from the termination blocks and patch panels in the communication rooms to the outlet locations at the workstations.

1.2 RELATED SECTIONS

A. Sections 270010 and 270500 contain general installation practices relevant to the communications cabling systems.

B. Section 270553 contains information regarding the labeling of horizontal cabling.

C. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 HORIZONAL VOICE & DATA CABLING

A. Category 6A Cable shall meet the following criteria:

1. Exceed TIA/EIA transmission performance requirements for Category 6A cable at frequencies up to 500MHz.
2. 100-ohm, 4-pair, 23 AWG solid bare copper conductor, unshielded twisted pair.
3. Standard: Comply with TIA-568-C.2 for Category 6a cables.
4. Industry standard conductor insulation color coding (blue, orange, green, brown).
5. Plenum rated, UL Listed type CMP marking on cable.
6. Product identifications and cable distance markings at regular intervals on cable.
7. Yellow in color (cable jacket).

8. ISO 9001 certified manufacturer.
9. Transmission performance verified by UL.
10. Normal product in inventory of local distributor.
11. Approved manufactures and product name/numbers: Berk-Tek, Commscope, General, Superior Essex, Systimax.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Sections 27 0000 and 27 1000 for all typical installation practices.

B. All horizontal cabling shall be labeled in accordance with labeling standards; refer to Section 27 0553.

3.2 HORIZONTAL CABLING INSTALLATION PRACTICES

A. The same manufacturer's product shall be utilized throughout the entire project for all voice and data horizontal cabling.

B. All horizontal cables shall be terminated at both ends on faceplate jacks and patch panels. Any cables pulled for spare cables shall be neatly coiling in ceiling support system, clearly labeled are both ends, and identified on as-built drawings.

END OF SECTION

SECTION 271543 - FACEPLATES & CONNECTORS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers faceplates and connectors utilized for all Division 27 sections.

B. Quantities for all communications faceplates and connectors shall be provided as required to terminate all outlet locations and cabling as shown on the floor plans.

1.2 RELATED SECTIONS

A. Sections 270010 and 270500 contain general installation practices relevant to the communications cabling systems.

B. Section 270553 contains information regarding the labeling of faceplates.

C. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems.

PART 2 PRODUCTS

2.1 FACEPLATES

A. Detention Grade Faceplates shall be utilized for all voice, data, and TV locations within the Secured Perimeter as shown on floor plans and detail drawings. Faceplates shall be constructed of 10-gauge cold rolled steel with a continuous welded for smooth construction and shall comply with the following additional requirements:

1. Failsafe No. SSB/SPC series (stainless steel) or owner approved equal.
2. Detention / security hardware and screws for plate fastening (See Specifications Section 11 1910).
3. Spacer washers as needed.

B. Stainless-Steel Faceplates shall be utilized for communications cabling location not within the security perimeter as shown on floor plans and detail drawings. Faceplates shall comply with the following requirements:

1. Stainless-steel construction.
2. Labeling field with clear plastic cover for pre-printed labels or provide clear permanent polyester adhesive labels with black ink.
3. Snap-in flush fit for connector modules.
4. Accept up to 4 connectors in single-gang or up to 8 connectors in double-gang configurations.
5. UL Listed.
6. Approved manufactures: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

C. Stainless-Steel Wall Phone Plate shall be utilized for all wall telephone outlet locations not within the security perimeter and shall comply with the following requirements:

1. Stainless-steel construction.
2. Accept Category 6 jack.
3. Single-gang.
4. Studs mounted in standard positions to accommodate any standard wall telephone.
5. UL Listed.
6. Approved manufactures: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

D. Raceway & Floor Box Outlets shall include 106-type electrical receptacle communication device adapters furnished and installed by the Division 27 contractor. The communication device adapters shall be gray plastic and shall provide flush mounting of jack from the connectivity hardware manufacturer. Raceways and floor boxes will be furnished and installed by the Division 26 contractor as noted on the drawings.

E. Modular Furniture Adapter Plates shall be furnished and installed by the Division 27 contractor for all communications outlets installed in modular furniture locations. The adapter modular shall be compatible with the modular furniture manufacturer, shall match the modular furniture color, shall be sized to include quantities indicated on floor plan drawings, and shall include blank inserts on open ports.

2.2 CONNECTORS

A. Category 6A Voice/Data Jack shall be utilized for voice/data cabling and shall comply with the following requirements:

1. TIA/EIA Category 6A compliant.
2. 8-position/8-conductor modular connector.
3. Blue in color for voice jacks; gray in color for data jacks.
4. Flush design for snap-in flush fitting on faceplate.
5. Approved manufacturers: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

B. F-81 Adapter shall be utilized for coaxial TV cabling and shall comply with the following requirements:

1. Female/Female pass-though fitting for connections to coaxial cable connections.
2. Gray in color.
3. Flush design for snap-in flush fitting on faceplate.
4. Approved manufacturers: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

C. Ruggedized Connector Assembly shall be provided for all voice and data outlet locations identified on the drawings. Connector shall be Category 6 outlets; connector housing shall be equipped with receptacle caps and shall be IP67 rated and to provided protection from dust, moisture, corrosion, oils, and vibrations. Provide 2-port single gang faceplates at wall locations and 4-port double gang faceplates as shown on drawings; faceplates shall be equipped with a rear sealing gasket. Approved manufacturer shall be Systimax (MIR-RJ45, MIR-CAP, IR12SP, and IR24SP) or equal form Commscope, Leviton, Ortronics, Panduit, or Siemon.

D. Blank Inserts shall be provided for all blank faceplate opening and shall comply with the following requirements:

1. Gray in color.
2. Flush design for snap-in flush fitting on faceplate.
3. Approved manufacturers: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to Sections 270000 and 271000 for all typical installation practices.

B. All faceplates shall be labeled in accordance with labeling standards; refer to Section 270553.

C. Verify modular furniture outlet locations and modular furniture manufacturer products with Architect prior to ordering communications devices for modular furniture locations.

3.2 FACEPLATE AND CONNECTOR INSTALLATION PRACTICES

A. All faceplates shall be installed vertically plumb. When faceplates allow for adjustments, the contractor shall always adjust plate vertically plumb. Where faceplates offer no adjustment (i.e., stainless steel), the contractor shall communicate to other trades the importance of installing back boxes vertically plumb and shall notify other trades of corrective actions necessary to repair severely out-of-plumb locations.

B. Faceplates shall be securely fastened. Screws shall be tight; however, not tightened to the point of deforming, bending, or cracking the faceplate.

C. Any deformed, broken, bent, or crack faceplates for connector hardware shall be replaced.

D. Faceplates installed in not secure areas may be installed with standard screw hardware. Faceplates installed in secure perimeter areas shall be installed with tamper-proof screws.

E. All snap-in faceplate jacks, adapters, and blank inserts shall be flush with the faceplate so the devices are not pushed through faceplates with connection of cables. Defective or broken components shall be replaces.

F. Excess cable shall not be coiled behind faceplates. Excess cable loop shall be pulled back into ceiling spaces.

G. Any blank faceplate connector opening shall be filled with blank inserts.

H. Category 6A jack shall be terminated with T568B the wiring scheme.

END OF SECTION

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SECTION 271619 - PATCH CORDS & CROSS CONNECT WIRE

PART 1 GENERAL

1.1 SUMMARY

A. This section covers copper horizontal cabling utilized by all Division 27 voice and data systems. Any patch cords, station cords, or cross connect wire required for audio, video, television, paging, intercom, or other systems utilizing the communications cabling infrastructure will be specified in other sections.

B. All patch cords and station cables shall be furnished to the Owner for installation by the Owner.

C. Quantities, colors, and lengths for all patch cords and station cables shall be indicated on the schedule at the end of this specification section.

1.2 RELATED SECTIONS

A. Sections 270010 and 270500 contain general installation practices relevant to the communications cabling systems.

B. Section 270100 contains important information regarding manufacturer's warranties for the voice and data cabling systems. Patch cables and stations cables shall conform to manufacturer warranty requirements.

PART 2 PRODUCTS

2.1 COPPER PATCH CORDS AND STATION CORDS

A. Category 6 Patch Cords and Station Cords shall comply with the following requirements:

1. Exceed TIA/EIA transmission performance requirements Category 6.
2. Impedance matched with manufacture of structured cabling system.
3. RJ45 plugs at both ends of cable terminated with T568B pin-out scheme.
4. Build-in strain relievers at plug terminations.
5. (4) 24 AWG stranded copper twisted pairs.
6. Unshielded (UTP).
7. Approved manufacturers: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

B. Category 6A Patch Cords and Station Cords shall comply with the following requirements:

1. Exceed TIA/EIA transmission performance requirements Category 6A.
2. Impedance matched with manufacture of structured cabling system.
3. RJ45 plugs at both ends of cable terminated with T568B pin-out scheme.
4. Build-in strain relievers at plug terminations.
5. (4) 24 AWG stranded copper twisted pairs.
6. Unshielded (UTP).

7. Approved manufacturers: Commscope, Leviton, Ortronics, Panduit, Siemon, Systimax.

C. Ruggedized Station Cords shall comply with the following requirements:

1. Exceed TIA/EIA transmission performance requirements Category 6.
2. Impedance matched with manufacture of structured cabling system.
3. Ruggedized plug to RJ45 plug terminated with T568B pin-out scheme.
4. Build-in strain relievers at plug terminations.
5. (4) 24 AWG stranded copper twisted pairs.
6. Unshielded (UTP).
7. Approved manufacturers: Systimax (CPCC312) or equal from Commscope, Leviton, Ortronics, Panduit, or Siemon.

2.2 OPTICAL FIBER PATCH CORDS AND STATION CORDS

A. 50/125µm Multi-Mode Patch Cords shall have same transmission performance characteristics as optical fiber backbone cable and comply with the following requirements:

1. Duplex cable construction with duplex LC connectors as indicated by Patch/Station Cord Schedule.
2. Build-in strain relievers at connector terminations.
3. Aqua-blue in color (outer cable jacket).
4. Factory assembled and 100% optically tested.
5. Approved manufacturers: ADC, Corning, Systimax.

PART 3 EXECUTION

3.1 GENERAL

A. All patch cords and station cords shall be furnished to Owner neatly boxed in original packaging from the manufacturer.

B. The Contractor is responsible secure storage for all patch/station cords and shall carefully inventory and document the quantities and time of delivery to the Owner.

C. Prior to ordering Category 6 and fiber patch cords, review the order with the Owner/Engineer to verify fiber connector type, cable colors, quantities, lengths, and delivery instructions.

SCHEDULE FOR COPPER PATCH/STATION CORDS			
Cable Type	Quantity	Length	Color
Category 6	25%	5 feet	gray
Category 6	25%	7 feet	gray
Category 6	25%	14 feet	gray
Category 6	25%	20 feet	gray

SCHEDULE FOR RUGGEDIZED STATION CORDS			
Cable Type	Quantity	Length	Color
Category 6	100%	20 feet	gray

SCHEDULE FOR OPTICAL FIBER PATCH/STATION CORDS			
Connector Type	Quantity	Length	Fiber Type
TBD	6	1 meter	62.5 µm (orange)
TBD	6	3 meter	62.5 µm (orange)
TBD	6	5 meter	50 µm (aqua)

END OF SECTION

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SECTION 274100 - AUDIO-VIDEO SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Audio Equipment.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking in walls and ceilings.

B. Section 09 2116 - Gypsum Board Assemblies: Suspended gypsum board ceilings and gypsum board partitions.

C. Section 09 5123 - Acoustical Ceilings: Suspended panel ceilings.

D. Division 26 - Electrical: Conduit and junction boxes for audio wiring, power supply for audio equipment.

1.3 SUBMITTALS

A. See Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Wiring diagrams.

C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.

D. Samples: For speaker fabrics, submit two samples 6 x 6 inch (152 x 152 mm) in size.

E. Samples: For case and frame finishes, submit two samples 6 x 6 inch (152 x 152 mm) in size, illustrating color and texture of finish.

F. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Experienced in manufacturing products specified in this section.

B. Installer Qualifications: Experienced in installation of the work of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment to project site in manufacturer's original unopened packaging. Inspect for damage and size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F (10 degrees C). Stack according to manufacturer's recommendations.

C. Acclimate equipment to building temperatures for 24 hours prior to installation, or in accordance with manufacturer's recommendations.

1.6 FIELD CONDITIONS

A. Maintain interior of building between 60 degrees F (15 degrees F) and 75 degrees F (24 degrees F) during and after installation of projection screens.

1.7 GENERAL REQUIREMENTS

A. All bidders must be fully insured and have a minimum of five years of experience in the audio and video installation business.

B. All bidders must submit a minimum of five, recently completed projects and references with similar installation parameters.

C. All speakers, amplifiers, processors, video projectors, video screens, connector boxes, cable and wire will be installed in a professional manner and must meet all local, state and national electrical and safety codes.

D. All cables must be labeled with a “Brady” type wrap around label. All connector plate labels must be laser engraved or silk-screened.

E. Contractor will provide a one-year warranty on all installed equipment and a two-year labor warranty covering all aspects of the installation. There will be no cost to the customer during this time. Misuse and abuse of equipment will be excluded from this warranty.

F. Contractor will provide two training sessions during the first 12 months of operation at no cost. Each session shall last at up to two hours.

G. Contractor will be responsible for programming all Digital Audio Processors and any remote controls in the specified systems. The contractor is solely responsible for complete installation, connection, proper set up and tuning of all audio and equipment.

H. Customer shall have a complete, properly operating system before contactor is paid final payment.

I. Contractor is completely responsible for all required equipment and accessory items required to have a complete, operational audio system that meets the owners expectations.

J. A final inspection of the completed installation will be conducted. If there are any unacceptable products or errors in the installation, they will be corrected at the contractor's sole expense.

K. Audio Contractor is not responsible for any high voltage electrical work or conduit installation that has been included in the electrical plan.

L. All equipment listed in this specification will be considered the preferred equipment list. However, substitutions will be considered, as long as such substitutions meet the same specifications, operation and dimensions of the original product. All substitutions must be approved in writing prior to the bid date. Bidder will provide a list of the original product with the substituted product listed after it. Bidder will also provide an engineering data sheet of each product, to be used as a substitution, no later than 7 days prior to the bid date.

M. Customer reserves the right to reject any product found to be of inferior quality to the original specification.

N. The equipment listed in this specification outlines the primary products required for a proper operating sound system, and is not, intended to be a "shopping list". There may be additional items required to complete certain aspects of the installation. Such products are the sole responsibility of the audio contractor.

PART 2 PRODUCTS

2.1 MANUFACTURES

A. Basis of design: Refer the equipment schedule, Audio Risers and Manufactures model numbers.

B. Substitutions: Products with equal quality and specifications can be considered as long as they are submitted and approved within 7 days of the bid date.

2.2 SCHEDULE OF AUDIO EQUIPMENT

A. Only primary equipment is listed for each area, and does not include, cabling, and other various items required to have a complete installation. Some items required to complete the installation may not be listed and are the responsibility of the Audio Contractor awarded the project.

B. See audio risers and blueprints for more details on equipment and design.

C. Main Gymnasium and Commons:

1. Description: The Main Gymnasium will have a shared sound system that can provide music playback, Live PA announcements and general paging. All amplifiers and equipment will be housed in a free-standing equipment rack ER1. There will be four

presets as follows: All on, East only, West only and Customer desired preset. The commons speakers will be fed from the same equipment rack and consist of the same PA feed as the gym. Set levels and delays in the commons to appropriate levels. Two wireless handheld microphones will be connected to a pair of 1/2 wave antennas mounted on the Gym wall (see print). Sequencing ON/OFF switch system needs to be provided. Program inputs and outputs on the DSP accordingly. A Broadcast feed has been requested, please coordinate location with the customer.

2. Speaker Rigging:

    a. All speakers need to be mounted and rigged using best industry standards, and a load ratio of 5:1. USA made rigging hardware including eye bolts, shackles and other hardware, is required to be used on all suspended speakers with at least three attachment points. Manufactured hardware needs to be used on all rigid mounted speakers or pendent speakers. Wire rope or chain is acceptable.
    b. Speakers SP1 and SP3 shall be suspended, and not hung down below the bottom of the gym trusses or beams.
    c. Speakers SP2 will be mounted with the proper U bracket and be mounted to the bottom of the gym trusses, angled to face the north and south seating and commons areas.
    d. Speakers SP1 will be angled towards each of the East and West main bleacher seating areas for best coverage. Speakers SP3 will be a dead hang straight down to cover the floor area.
    e. SUB -sub-woofer will be mounted in a manner that the drivers face the gym, not straight down. Sub-woofer requires four attachment rigging points.
    f. SP4 will be mounted to the bottom of the beams or from the ceiling using the included wire that comes with the speakers. See print for details.

3. SCHEDULE:

QTY	EQUIPMENT
8	JBL AM5212/66 speakers in white finish
4	JBL AM5212/95 speakers in white finish with matching U bracket
2	JBL AM5212/00 Speakers in white finish
1	JBLASB6125 dual 15” Subwoofer
6	JBL Control 67HCP/T High Ceiling pendent speaker
1	Lowell LER-4022 equipment rack with solid rear door, perforated front door and matching caster cart.
1	Lowell MFG. RPSB-R rack mount on/off panel
3	Lowell MFG RPC-2-20-SCD Rack (requires 3-20 amp receptacles.)
1	Furman M8x2 power conditioner
1	Lowell MFG UDP314 rack drawer
3	RDL -DS-J3 single gang input device
1	Lowell MFG SG6P rack panel
1	Symetrix Prism 12x12 processor
1	Symetrix ARC-SW-2 programable control panel
1	Symetrix ARC-SW4E selector panel
1	Shure UA844-SWB antenna distribution
2	Shure SLXD24/58 wireless system
1	Shure SCM-800 rack mixer
2	Crown Audio DCI 4/600 4 channel power amplifier
1	Crown Audio DCI2/1250 power amplifier

D. Multipurpose Room 228.

1. Description: This room will have four surface mount speakers, two mounted on each side. The system will have the ability to play music, use a wireless headset and handheld microphones. In addition to the rackmount Bluetooth player, there will be a surface mounted 3.5mm wall, jack that allows connection of other music sources such as MP3

player and phones (mounting location TBD) This will be a recessed rack into the wall, so coordinate the equipment rack size and location with the owner/architect.

2. SCHEDULE:

QTY	EQUIPMENT
1	Furman M-8X2 Power Conditioner
1	Shure BLX14R-SM35 wireless body pack microphone system
1	Shure BLX24R/SM58 wireless handheld microphone system
1	JBL CSM28 mixer
1	Crown Audio CDI2000 amplifier
1	Lowell steel equipment rack with perforated locking front door and caster plate. (max 22”w x 22”d x 45”h)
1	Lowell UDP314 rack drawer
1	Denon Pro DN300BR Bluetooth receiver with remote antennas
1	RDL-DS-CIJ3

E. Wellness Center Room 229.

1. Description: The wellness center will be used by students and members of the community. There will many different people with access to the sound system. Coordinate best practices for this with the owner during training. Consult with the owner as to the type of music source desired. (subscription based or individuals connected to the system). See blue-print notes for speaker locations and mounting details. All speakers will be set to 70 volt and tapped to appropriate setting.
2. SCHEDULE:

QTY	EQUIPMENT
1	Furman M-8X2 rackmount power conditioner
1	JBL VMA1240 70-volt mixer amplifier
1	Lowell MFG 2 space rack drawer
1	Lowell MFG 6 space swing-out wall-mount rack with locking perforated door
1	RDL DS-CIJ3

F. Additional Equipment.

1. SCHEDULE:

QTY	EQUIPMENT
1	Whirlwind Pod-MIXai scorer's table mixer
2	Whirlwind MK450 microphone cables or equivalent
2	Whirlwind MK410 microphones cables or equivalent
4	3.5mm to 3.5mm cables 6ft long
2	Atlas Round base Microphone Stands
1	Allen & Heath ZEDi-10 compact mixer
1	Shure SM58 announcers' microphone with desktop stand

G. Section I: Wire, cable and connectors.

1. 70 volt speaker distribution speaker cable will be West Penn 25225B 16ga. 2 conductor plenum rated cable.
2. All standard impedance speakers will use West Penn 227 12ga. 2 conductor cable or equivalent.
3. Microphone and Line level cable will be West Penn 454 22ga. 2 conductors with shield or equivalent.
4. Cat6e cable will be West Penn 4246 4 pair, 23 ga.
5. All XLR, ¼", speakon and other connectors will be a Neutrik Brand product.

H. Section J: Electrical.

1. Electrical contractor is responsible for all conduit, back boxes and labor required for the audio system rough in.
2. Audio contractor is responsible for all cover plates and connection covers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate is finished and ready to accept equipment installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed equipment are correctly sized.

D. Verify type and location of electrical connections.

E. Do not install equipment until climate control systems are in place and interior painting and other finishes are completed.

3.2 PREPARATION

A. Coordinate audio equipment installation with electrical systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Install amplifiers and other audio equipment in racks as specified and as indicated on drawings.

C. Install plumb and level.

D. Install audio equipment ready for connection to power and control systems by others.

E. Adjust equipment and related hardware in accordance with manufacturer's instructions for proper placement and operation.

F. Test all sound systems for proper working condition. Adjust as needed.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Removing existing groundcover and grass.
2. Stripping and stockpiling topsoil.

B. Related Sections include the following:

1. Section 312300 "Trenching Excavation and Backfilling" for soil materials, excavating and backfilling.
2. Section 312000 “Earth Moving” soil materials, excavating, and site grading.
3. Section 312500 “Erosion and Sedimentation Controls” for erosion and sedimentation control measures.
4. Section 321132 “Base Courses” for aggregate material and placement.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; 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 in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Utility Locator Service: Notify Gopher State One Call for area where Project is located before site clearing. The phone number for Gopher State One Call is 1-800-252-1166.

1.6 CONTROL OF EROSION AND SEDIMENT

A. Control of erosion and sediment shall be in conformance with, MPCA guide for Best Management Practices for sediment and erosion control on construction sites in Minnesota. The Contractor shall be responsible for furnishing, constructing and maintaining erosion and sediment control, and for any costs relating thereto.

B. See Section 312500.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 312500 "Trenching Excavation and Backfilling" and “Earth Moving”.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

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. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

B. See Section 312500.

3.3 UTILITIES

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

3.4 CLEARING AND GRUBBING

A. The Engineer will establish construction lines and designate all trees, shrubs, plants and other things to remain. All surface objects and other obstructions not designated to remain, shall be cleared as required and properly disposed of.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.
6. All work shall be considered incidental to the Project.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

C. The Contractor shall be responsible for the proper removal, care and resetting of all portable culverts, drainage pipe and other minor structures authorized by the Engineer for temporary relocation from alignment of the work.

D. Removal of surface improvements where not indicated to be removed on the plans such as street paving, curbs, gutters and sidewalks shall be held to a minimum. When it is necessary to excavate through existing asphalt or concrete paving, sidewalks, or curb and gutter; before excavating, the cut shall be first made with a concrete saw for the full depth of the existing surface. All material removed and the method employed to replace the surface improvement to its original grade, depth and alignment shall be first authorized and approved by the Engineer. Rubble material shall be considered property of the Contractor and be disposed of by the Contractor at a site provided by the Contractor.

E. All material generated by this project must be disposed of by the Contractor at a permitted site. Depending on what material is generated and whether it is contaminated or uncontaminated will determine which permitted facility can accept it.

3.5 TOPSOIL STRIPPING AND STOCKPILING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water.

1. Limit height of topsoil stockpiles to 72 inches (6 feet).
2. Do not stockpile topsoil within tree protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 DISPOSAL

A. Disposal: 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.

END OF SECTION

SECTION 312000 - EARTH MOVING

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. Preparing subgrades for pavements, lawns and grasses.
2. Excavating and backfilling for site grading.

B. Related Sections include the following:

1. Section 311000 "Site Clearing" and “Erosion and Sedimentation Controls” for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 321132 “Base Courses” for aggregate materials, testing, and placement.
3. Section 321216 “Plant Mixed Asphalt Pavement” for mineral aggregates, bituminous binder, bituminous classification, job mix requirements, and testing.
4. Division 32; Section 321613 “Concrete Curb and Gutter, Valley Gutter, and Fillet Sections” for concrete mix design, testing, and placement.
5. Section 329200 "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

1.3 DEFINITIONS

A. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

B. Unclassified Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by an Engineer, shall be without additional compensation.

C. Fill: Soil materials used to raise existing grades.

D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

1.5 TESTING AND INSPECTION SERVICE

A. It shall be the responsibility of the Contractor to employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

1.6 DEWATERING SITE

A. A Temporary Water Right Permit may be required if the following types of water need to be pumped out of the construction site:

1. Ground water;
2. Surface water.

B. The Contractor shall be responsible for obtaining any permits associated with dewatering the site and any costs relating thereto.

1.7 GUARANTEE

A. During a period of one year from and after the date specified in the Certificate of Substantial Completion of the work embraced by this Contract, the Contractor shall make all needed repairs or replace as necessary any damage caused by settlement, at no additional cost to the Owner.

1.8 SOIL INVESTIGATIONS

A. Soils investigations were conducted at the site. Copies of the complete report are available upon request. Contractor shall review geotechnical report and comply with recommendations contained therein.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, and CL or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Imported Backfill: Imported material consisting of well-graded granular material with less than 50 percent passing the No. 40 sieve and less than 5 percent passing the No. 200 sieve.

E. Backfill Materials: The material obtained from the project excavations may be used as site backfill unless otherwise shown on the Drawings, Geotechnical Report, or specified in these Specifications, provided that all organic material, rubbish, debris, rocks greater than three (3) inches in any dimension, and other objectionable materials are first removed. Broken Portland cement concrete and bituminous type pavements obtained from the project excavations will not be permitted in the backfill.

F. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; 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 in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

PART 3 EXECUTION

3.1 SITE PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1. The Engineer will establish construction lines and designate all tress, shrubs, plants and other things to remain. All surface objects and all trees, stumps, roots and other obstructions not designated to remain, shall be cleared as required and properly disposed of.
2. The Contractor shall be responsible for the proper removal, care and resetting of all portable culvers, drainage pipe and other minor structure authorized by the Engineer for temporary relocation from alignment of the work.

3. Removal of surface improvements where not indicated to be removed on the plans such as street paving, curbs, gutters and sidewalks shall be held to a minimum. When it is necessary to excavate through existing asphalt or concrete paving, sidewalks, or curb and gutter; before excavating, the cut shall be first made with a concrete saw for the full depth of the existing surface. All material removed and the method employed to replace the surface improvement to its original grade, depth and alignment shall be first authorized and approved by the Engineer. Rubble material shall be considered property of the contractor and be disposed of by the Contractor at a sited provided by the Contractor.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 311000 "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Section 312500 "Erosion and Sedimentation Controls," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

C. Drainage:

1. The Contractor shall at all times during the construction of the roadway provide and maintain ample equipment to remove and dispose of all water entering the excavation or other parts of the work. All grading in the vicinity of the roadway shall be performed in such a manner as to provide positive surface drainage away from the site and to prevent surface water from flowing into the roadway.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 TOPSOIL

A. Topsoil (full depth) in excavation areas shall be stripped from the site and stored in stockpiles at a site away from the project to minimize waste. The Contractor shall restore topsoil to depth as indicate in the Drawings or to match surrounding depth.

3.5 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations.

3.6 PROTECTION OF EXCAVATION

A. The Contractor shall provide adequate signs, barricades, flashing lights and watchmen and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by flashing signal lights in proper working order, which shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction with reflective markings to increase their visibility at night. Suitable signs shall be so placed as to show in advance where construction, barricades or detours exist.

B. The Contractor shall at all times so conduct his work as to insure the least possible construction to traffic and inconvenience to the general public and shall at all times maintain access to existing public and private property.

3.7 PROTECTION OF EXISTING UTILITIES

A. Existing utilities shall be protected from damage during the excavation and backfilling operations. If damaged, the Contractor shall immediately contact the appropriate utility company. Any damage shall be repaired by the Contractor, at his expense or by the utility company, at possible expense to the Contractor. It shall be the Contractor's responsibility to arrange with each utility company known to maintain utilities in the area of work to have all underground facilities located and staked by the utility company prior to excavation.

B. It is understood and agreed that the Contractor has considered in the bid the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans. Additional compensation will not be allowed for delays, inconvenience or damage sustained due to interference from the utility appurtenances or the operation of moving them.

3.8 RESPONSIBILITY

A. It shall be the responsibility of the Contractor to provide all materials, including borrow, earth cover, and topsoil.

3.9 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include

rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 6 inches beneath bottom of concrete slabs on grade.
    c. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 36 inches wide.

3.10 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades as indicated in the Plans and Geotechnical Engineering Report.

3.11 SUBGRADE PREPARATION

A. The Contractor shall prepare the subgrade, for the areas designated in the Plans, in accordance with the Plans and Geotechnical Engineering Report.

B. The compacted subgrade shall be test rolled using a fully loaded aggregate truck (tandem) in a pattern approved by the Engineer. The subgrade stability shall be considered adequate when the surface shows less than one (1) inch of yielding or rutting after one pass, or as otherwise approved by the Engineer.

C. This work along with subgrade inspection shall be considered incidental to the project.

3.12 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below pavements in accordance with Mn/DOT Section 2111, Test Rolling, to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
4. Excess yielding or rutting of more than 2-inches, Subgrade will be considered unstable and require additional effort by the Contractor to reach acceptable Subgrade stability.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.13 FIELD QUALITY CONTROL

A. Allow testing agency to inspect and test each subgrade and each base course layer. Do not proceed until test results for previously completed work verify compliance with requirements.

B. Perform field in-place density tests according to ASTM D1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, refer to the calibration curves furnished with the moisture gauges according to ASTM D 3017. A schedule of density tests may be submitted to the Engineer for approval.

C. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 500 sq. ft. or less of paved area but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 25 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.
4. Engineered Fill below the footings and floors: at least one test for every 2,000 square feet and every 2-foot thickness of fill placed. Engineered Fill shall be placed and compacted per the Geotechnical Report.

D. When testing agency reports that subgrades or fills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained. In the event of a compaction test that does not meet the required density, the Contractor will be required to correct all areas that have been compacted since the last passing test at no cost to the Owner. The Contractor has the option of performing additional compaction tests between the last pasting and the failing compaction test at no cost to the Owner.

E. All costs for removal, replacement, recompaction and retesting of the material shall be paid for by the Contractor.

F. If soil properties change over the project area additional Proctor tests shall be completed. Additional proctor tests shall be considered incidental to other associated bid items.

3.14 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.15 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

    1. Stockpile soil materials away from edge of excavations.

3.16 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

    1. Construction below finish grade including, where applicable, subdrainage, sanitary sewer, manhole, and service connections.
    2. Surveying locations of underground utilities for Record Documents.
    3. Testing and inspecting underground utilities.
    4. Removing trash and debris.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.17 EXCAVATION, EMBANKMENTS AND GRADING

A. This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct the roadways as well as other areas for drainage, or other purposes in accordance with these specifications and in conformity to the dimensions and typical section shown on the plans.

    1. Classification: All material will be considered as "Unclassified Excavation". Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature, which is not otherwise classified. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction.

        a. All unsuitable material shall be disposed of in waste areas approved by the Engineer. All waste areas shall be graded to allow positive drainage of the area and of adjacent areas.
        b. Those areas outside of the roadway in which the top layer of soil material has become compacted, by hauling or other activities of the Contractor shall be scarified and disked to a depth of 4 inches in order to loosen and pulverize the soil.

    2. Topsoil: Topsoil previously stockpiled shall be placed uniformly over all areas disturbed by construction operations after completion of those operations. The topsoil shall be spread to a uniform minimum thickness of six (6) inches or to match surrounding depth as directed by the Engineer and in such a manner that seeding can be accomplished with a minimum of additional soil preparation or tillage. If there is not adequate topsoil available from the site, the Contractor shall provide an approved topsoil material in accordance with Soil Materials previously defined.
    3. Excavation: No excavation shall be started until the work has been staked out by the Engineer. All suitable excavated material shall be used in the formation of embankment, subgrade, or for other purposes shown on the plans.

a. When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be wasted. When the volume of excavation is not sufficient for constructing the fill to the grades indicated, the deficiency shall be obtained from borrow areas.
b. The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the work.
c. Stones or rock fragments larger than 4 inches in their greatest dimensions will not be permitted in top 6 inches of the subgrade.
d. In cuts, all loose or protruding rocks on the back slopes shall be broken loose or otherwise removed to line of finished grade of slope. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the Engineer.

4. Undercutting: Material unsatisfactory for subgrades, roads, or shoulders shall be excavated to a depth specified by the Engineer, below the subgrade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of by the Contractor. The excavated area shall be refilled with suitable material obtained from the grading operations or borrow areas and thoroughly compacted by rolling. The necessary refilling will constitute a part of the embankment.
5. Borrow Excavation: Borrow area(s) shall be obtained by the Contractor.
6. Preparation of Embankment Area: When an embankment is to be constructed to a height of 4 feet or less, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surface shall be completely broken up by disk or by plowing or scarifying to a minimum depth of 12 inches. This area shall then be compacted. Equipment used in preparation of the embankment shall be approved by the Engineer prior to execution. If the equipment in the opinion of the engineer cannot achieve the desired finished product, it shall be removed from the project site.

    a. No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

7. Formation of Embankments: Embankments shall be formed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section, unless otherwise approved by the Engineer.

    a. The grading operations shall be conducted, and the various soil strata shall be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.
    b. Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.
    c. The material in the layer shall be compacted at no lower than two (2) percent of optimum moisture content before rolling to obtain the prescribed compaction. In order to achieve a uniform moisture content throughout the layer, wetting or drying of the material and manipulation shall be required when necessary. Sprinkling of dry

material to obtain the proper moisture content shall be done with approved equipment that will sufficiently distribute the water.

d. Compaction areas shall be kept separate, and no layer shall be covered by another until the proper density is obtained.
e. During construction of the embankment, the Contractor shall route his/her equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.
f. When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future surfaced areas. Stones or fragmentary rock larger than 4 inches in their greatest dimensions will not be allowed in the top 6 inches of the subgrade. Rock fill shall be brought up in layers as specified or as directed and every effort shall be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated by the Engineer.
g. Frozen material shall not be placed in the embankment, nor shall embankment be placed upon frozen material.

8. Embankment: Embankment will not be paid for directly but shall be subsidiary work pertaining to the several classes of excavation.
9. Haul: All hauling will be considered a necessary and incidental part of the work. Its cost shall be considered by the Contractor and included in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

3.18 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.19 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent (+/-) of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.20 COMPACTION OF SOIL SUBGRADE AND BASE COURSES

A. The Contractor shall compact and shape the subgrade for its full width as may be necessary to produce the required density and stability in the top 6-inches of the subgrade and the required grade and cross-section.

B. The Contractor shall compact and shape the aggregate base course(s) on a prepared subgrade. The full thickness of each course shall be compacted prior to placement of the next course. Each course shall be considered to be 3 inches in compacted thickness.

C. Percentage of Maximum Dry Density Requirements: Compact subgrade, subbase, and base materials using the Specified Density Method to not less than the following percentages of maximum dry density according to ASTM D698 (Standard Proctor), Mn/DOT Sections 2112.3 and Section 2211.3C1 respectfully:

1. General Subgrade shall be 98 percent of maximum density.
2. Base Course shall be 98 percent of maximum density.

3.21 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus, or minus 1 inch.
2. Walks: Plus, or minus 1 inch.
3. Pavements: Plus, or minus 1/2 inch.

C. Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall take all precautions necessary to protect the subgrade from damage. Contractor shall limit hauling over the finished subgrade to that which is essential for construction purpose.

D. In those areas upon which an improved surface is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 6-foot straightedge applies parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2-inch or shall not be more that 0.05-foot from true grade as established by grade hubs or pins. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting by sprinkling and rolling.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
2. Before final acceptance of the work the Contractor shall clear the entire work site of equipment, unused materials, and rubbish so as to present a satisfactory clean and neat appearance. Agricultural areas shall be scarified with a farm type disc and smoothed out with an agriculture type drag. The final surface shall be smooth and free of rocks and debris.

END OF SECTION

SECTION 312300 - TRENCHING, EXCAVATION AND BACKFILLING

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. Excavating and backfilling for utility trenches.

B. Related Sections include the following:

1. Section 311000 "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 312000 “Base Courses” for aggregate material, testing, and placement.
3. Section 321216 “Plant Mixed Asphalt Paving” for mineral aggregates, bituminous binder, bituminous classification, job mix requirements, and testing.
4. Section 321613 “Concrete Curb and Gutter” for concrete mix designs, testing, and placement.
5. Section 329200 “Turf and Grasses” for finish grading, including preparing and placing topsoil and planting soil for lawns.
6. Section 331000 “Water Utilities” for watermain pipe, water service pipe, fittings, valves, fire hydrants, and other appurtenances.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Granular embedment placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Granular Embedment: Aggregate course placed over the excavated subgrade in a trench before laying pipe.

C. Pipe Foundation Material: Aggregate used where soft, spongy, unstable or other similar material is encountered and removed upon which the granular embedment material or pipe is to be places.

D. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 3/4 cu. yd. for footing, trench, and pit excavation that cannot be

removed by rock excavating equipment without systematic drilling, ram hammering, ripping, or blasting, when permitted.

E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

F. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

G. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

A. It shall be the responsibility of the Contractor to determine Contractor's own satisfaction the location and nature of surface and subsurface obstacles and the soil and water conditions that will be encountered during the work.

B. Test borings and other exploratory operations may be made by the Contractor at their own expense. Contractor shall coordinate such tests with the Owner.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

E. The contractor shall operate his equipment only in those areas designated on the Drawings, or by the Engineer as construction areas. Indiscriminate operation of equipment outside of designated construction areas will not be permitted.

F. No claim for additional payment will be accepted because of the nature of subsurface in which work under this project is performed.

G. No claim for additional payment will be accepted for repairs made to subgrade due to weather related problems.

1.5 TESTING AND INSPECTION SERVICE

A. It shall be the responsibility of the Contractor to employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

1.6 GUARANTEE

A. During a period of one year from and after the date specified in the Certificate of Substantial Completion of the work embraced by this Contract, the Contractor shall make all needed repairs or replace as necessary any damage caused by settlement, at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, and CL or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Select Backfill: Material from excavation or imported material consisting of earth free from large stones, frozen material vegetation, cinders, ashes and other organic material. Select material shall be sufficiently pulverized to permit proper compaction.

E. Backfill Materials: The material obtained from the project excavations may be used as backfill unless otherwise shown on the Drawings or specified in these Specifications, provided that all organic material, rubbish, debris, frozen material, rocks greater than six (6) inches in any dimension, and other objectionable materials are first removed. Broken Portland cement concrete and bituminous type pavements obtained from the project excavations will not be permitted in the backfill. Stones larger than 3 inches in diameter shall not be placed within 2 feet of the top of the pipe.

F. Imported Backfill: Imported material consisting of well-graded granular material with less than 50 percent passing the No. 40 sieve and less than 5 percent passing the No. 200 sieve.

G. Granular Embedment for Sanitary Sewer: Clean angular well-graded, crushed rock with 95% passing the ¾" sieve and 95% retained on the #4 sieve.

H. Granular Embedment for Water Main: Minus 1-inch granular material with not more than 10% passing the #200 sieve.

I. Granular Embedment for Storm Sewer: Clean angular well-graded, crushed rock with 95% passing the 3/4-inch sieve and 95% retained on the #4 sieve.

J. Pipe Foundation Material: Aggregate shall be crushed rock in the size range from 3/4 inch to 1-1/2 inch. Ledge rock is not required.

K. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; 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 in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

L. Fill Concrete: Minimum 28-day compressive strength shall be 2500 psi.

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 earthwork operations.

1. The Engineer will establish construction lines and designate all trees, shrubs, plants and other things to remain. All surface objects and all trees, stumps, roots and other obstructions not designated to remain, shall be cleared as required and properly disposed of.
2. The Contractor shall be responsible for the proper removal, care and resetting of all portable culverts, drainage pipe and other minor structures authorized by the Engineer for temporary relocation from alignment of the work.
3. When it is necessary to excavate through existing asphalt or concrete paving, sidewalks, or curb and gutter; before excavating, the cut shall be first made with a concrete saw for the full depth of the existing surface. All material removed and the method employed to replace the surface improvement to its original grade, depth and alignment shall be first authorized and approved by the Engineer. Rubble material shall be considered property of the Contractor and be disposed of by the Contractor at a permitted site or a site provided by the Contractor.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 311000 "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Section 312500 "Erosion and Sedimentation Controls," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost as specified in Section 072100 “Thermal Insulation.”.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Drainage:

1. The Contractor shall at all times during the construction of the work provide and maintain ample equipment to remove and dispose of all water entering the excavation or other parts of the work. The excavation shall be kept dry until all work therein has been completed and backfilling commenced. All grading in the vicinity of the excavation shall be performed in such a manner as to provide positive surface drainage away from the site and to prevent surface water from flowing into the excavation.
2. No reinforcing steel shall be placed in water, and no water shall be allowed to rise over any reinforcing steel before the concrete has been placed. No water will be allowed to come in contact with any concrete within twenty-four (24) hours after placement unless shown on the Drawings or authorized by the Engineer.

C. Dewatering.

1. Trench Dewatering: During trenching operations for installation of utilities, when groundwater is encountered in sufficient quantities to require continuous pumping with well points or other special handling in order to maintain a satisfactory dry trench condition, it shall be considered wet trench. In such case, the Contractor shall submit to the Engineer for approval, his proposed method of disposing of the water prior to initiating the dewatering procedure. The Contractor shall be responsible for any damage occurring from disposal of water. Trenches for utilities shall be dewatered to an elevation of at least one (1) foot below the pipe invert elevation. No separate measurement or payment will be made for dewatering.
2. Structure Excavation Dewatering: During excavation for structures other than utility trenches, the Contractor shall provide suitable equipment including, if necessary, pumping with well points or other special handling to keep the excavation dry as required by Trench Dewatering, above. The Contractor shall be responsible for any damage occurring from disposal of water. Excavation for structures shall be dewatered to an elevation of at least two (2) feet below the bottom of the excavation. No separate measurement or payment will be made for dewatering.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 PROTECTION OF EXCAVATION

A. The Contractor shall provide suitable sheeting, shoring, and bracing to protect all excavations to provide safe working conditions, and in strict conformance with safety regulations. Damage or injury resulting from settlement, slides, cave-ins, water pressure, or other causes shall be the responsibility of the Contractor and damage shall be repaired at his own expense.

B. The Contractor shall provide adequate signs, barricades, flashing lights, and watchmen and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by flashing signal lights in proper working order, which shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction with reflective markings to increase their visibility at night. Suitable signs shall be so placed as to show in advance where construction, barricades, or detours exist.

C. The Contractor shall at all times so conduct his work as to insure the least possible obstruction to traffic and inconvenience to the general public and shall at all times maintain access to existing public and private property.

3.5 PROTECTION OF EXISTING UTILITIES

A. Existing utilities shall be protected from damage during the excavation and backfilling operations. If damaged, the Contractor shall immediately contact the appropriate utility company. Any damage shall be repaired by the Contractor, at his expense or by the utility company, at possible expense to the Contractor. It shall be the Contractor's responsibility to arrange with each utility company known to maintain utilities in the area of work to have all underground facilities located and staked by the utility company prior to excavation.

B. It is understood and agreed that the Contractor has considered in the bid the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans. Additional compensation will not be allowed for delays, inconvenience or damage sustained due to interference from the utility appurtenances or the operation of moving them.

3.6 RESPONSIBILITY

A. It shall be the responsibility of the Contractor to provide all materials, including borrow, earth cover, and topsoil.

3.7 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 6 inches beneath bottom of concrete slabs on grade.
    c. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 36 inches wide.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations. All excavation shall be made by open cut method unless otherwise shown on the Drawings.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Under no circumstances will it be permissible to leave a pipeline excavation unprotected or unguarded when work is not actually in progress on the pipeline. If it becomes necessary for the Contractor to leave the pipeline excavation for any reason, it shall be the Contractor's responsibility to leave one of his employees at the site to watch the site so unauthorized personnel do not enter the excavation.

E. Unless otherwise required, the pipeline excavation shall be completely backfilled at the end of each day's operation, and reopened when work resumes on this portion of the line. The Contractor shall be responsible to mark the end of the pipe in such a manner that it may be easily found when the ditch is reopened.

F. Excavation for structures and accessories, including manholes, shall be of sufficient size so as to leave at least twelve (12) inches of clear space between the outer surface of the structure and the embankment or sheathing and bracing which may be used to hold and protect them. Unless otherwise shown on the Drawings or authorized by the Engineer, the bottom of the excavation shall not be undercut below the grades established. Manhole installations shall be completed and completely backfilled the same day in which the excavation was started.

G. Undercutting: where rock is encountered at the bottom of the utility trenches, the rock shall be excavated to a minimum over-depth of six (6) inches below the grade established for the trench bottom and replaced with bedding material.

H. Where soft, spongy, unstable or other similar material is encountered upon which the bedding material, structure or pipe is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with a subgrade stabilization pipe foundation material as directed by the Engineer. Foundation material required to replace unauthorized excavated materials shall be furnished and installed by the Contractor at his own expense. No additional payment will be made for undercutting.

I. All excavation required to install utilities shall be considered incidental. All excavated material shall be considered incidental regardless of material encountered. The Contractor shall consider in their bid all possible materials encountered. All waste material displaced from installation of utilities shall become the Contractors responsibility to dispose of offsite. All work associated from the disposal including haul shall be considered incidental.

3.9 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If the Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
4. Excess yielding or rutting of more than 2-inches, subgrade will be considered unstable and require additional effort by the Contractor to reach acceptable subgrade stability.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.10 FIELD QUALITY CONTROL

A. Allow testing agency to inspect and test each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

B. Perform field in-place density tests according to ASTM D1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, refer to the calibration curves furnished with the moisture gauges according to ASTM D 3017. A schedule of density tests may be submitted to the Engineer for approval.

C. When testing agency reports that backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained. In the event of a compaction test that does not meet the required density, the Contractor will be required to correct all areas that have been compacted since the last passing test at no cost to the Owner. The Contractor has the option of performing additional compaction tests between the last passing and the failing compaction test at no cost to the Owner.

D. All costs for removal, replacement, recompaction and retesting of the material shall be paid for by the Contractor.

E. Testing Frequency:

1. Utility Trenches - A minimum of one density test and moisture content shall be made for every 400 lineal feet of trench per four (4) feet of depth. A minimum of one (1) standard density and optimum moisture determination shall be made for each utility trench and

one (1) additional test for each change in backfill. Test location shall be at the Engineer's discretion.

3.11 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.12 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations.

3.13 BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact granular embedment on trench bottoms and where indicated. Shape granular embedment to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact final backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the granular embedment material.

1. Carefully compact final backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent (+/-) of optimum moisture content. Soils having an optimum moisture of greater than 15 percent shall be compacted at no more than 6 percent above optimum moisture, unless otherwise specified. Optimum moisture will be determined by geotechnical testing firm.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Compaction by bucket packing is not allowed.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Compact backfill of fill layers in unimproved areas to a density at least equal to that of the surrounding soil.
2. Compact backfill or fill layers in areas containing surface improvements or future surface improvements in accordance with MnDOT Section 2105.3F1 at the following percent maximum dry density:

a. Upper 3 feet shall be compacted to a density of not less than 98 percent of maximum density.
b. Below the upper 3 feet shall be compacted to a density of not less than 98 percent of maximum density.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

1. All material generated by this project must be disposed of at a permitted site. Depending on what material is generated and whether it is contaminated or uncontaminated will determine which permitted facility can accept it. Permitted facilities include construction and demolition debris sites, restricted use sites, and regional landfills.
2. Before final acceptance of the work the Contractor shall clear the entire work site of equipment, unused materials, and rubbish so as to present a satisfactory clean and neat appearance. The final surface shall be smooth and free of rocks and debris.

END OF SECTION

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SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections apply to this Section.

1.2 SUMMARY

A. This section of the Specifications includes the following:

1. Storm Sewer Inlet Protection Device.
2. Temporary Vehicle Construction Entrance.
3. Concrete Washout Area.
4. Erosion Control Blanket.
5. Erosion Control Wattle.
6. Silt Fence.
7. Turf Reinforcement Mat.

B. Related Sections include the following:

1. Section 311000 “Site Clearing” for temporary erosion and sedimentation control measures, site stripping, stripping and stockpiling topsoil, of above - and below - grade improvements and utilities.
2. Section 312000 “Earth Moving” soil materials, excavating, and site grading.
3. Section 321132 “Base Courses” for aggregate material and placement.
4. Section 329200 “Turf and Grasses” finish grading, including preparing and placing topsoil and planting soil for lawns.

1.3 STANDARD SPECIFICATIONS REFERENCE

A. The work to be performed under this Contract shall be governed by the Minnesota Department of Transportation “Standard Specifications for Construction, 2018 Edition”, which specifications shall apply as though printed in full with these Contract Documents.

B. Any reference to State, State of Minnesota, or Department of Transportation with regard to work or services to be completed or furnished shall be taken to mean CGB School District herein referred to as Owner, for purposes of this project.

C. Any reference to the Engineer shall mean the firm of Banner Assoc. Inc., Consulting Engineers, Brookings, South Dakota, for the purpose of this project.

PART 2 PRODUCTS

2.1 STORM SEWER INLET PROTECTION DEVICE

A. All inlet sediment control devices shall be installed as shown on the Drawings or as directed by the Engineer.

2.2 TEMPORARY VEHICLE CONSTRUCTION ENTRANCE AGGREGATE

A. Temporary vehicle construction entrance aggregate shall be a washed natural aggregate ranging in size from 3-inch to 6-inch.

2.3 CONCRETE WASHOUT AREA

A. Concrete washout area shall be placed at a central location as shown on the Drawings or as directed by the Engineer.

2.4 EROSION CONTROL BLANKET

A. Erosion control blanket shall be a natural, stitched excelsior blanket that provides a temporary organic cover to reduce erosion, protect seeds, enhance germination, and accelerates vegetation re-growth.

B. Erosion control blankets shall consist of highly absorbent wood fibers woven into an interlocking mat. A fabric net of either twisted paper cord, cotton cord, or extruded plastic shall be applied to one side of the wood fiber mat to hold the wood fibers in place. The erosion control blanket shall have the following physical properties:

Fiber:	Great Lakes Aspen Excelsior with no weed seeds Curled, interlocking fibers with barbed edges
Fiber Size:	80% of fibers a minimum of 6” (15.2 cm) long 0.038” ± 0.008” wide x 0.018” ± 0.003” thick (0.97 mm ± 0.20 mm wide x 0.46 mm ± 0.08 mm thick)
Weight*:	0.73 lb/yd2 (0.40 kg/m2) ± 10% @ 22% Moisture
Thread Material:	HT Polypropylene with UV degrader additive
Thread Pattern:	4” wide x 4” long (10.2 cm x 10.2 cm) ± 0.50” (1.3cm)
Net Material:	Polypropylene (green or white with UV degrader additive)
Net Openings:	1.0” wide x 2.0” long (25.4 mm wide x 50.8 mm long)
Net Configuration:	Top side only
*Weight is based on a dry fiber weight basis at time of manufacture. Baseline moisture content of Great Lakes Aspen excelsior is 22%.	
Use staple pattern "C" as a minimum for installing erosion control blanket.	

C. The weight and dimensions of each roll at the time of manufacture shall be stenciled or written on the wrapper or attached tag.

D. Rolls shall be stretch wrapped to protect against the elements prior to installation.

E. Staples used to hold blankets in place shall be of two types. The first type shall be in the shape of a "U", shall be 11 gage minimum industrial quality, bright basic wire, with dimensions 10" x 2" x 10". The second type shall be in the form of a "T", shall be 6 gage minimum industrial quality, bright basic wire, with dimensions 12" x 12", and shall be welded at the "T".

2.5 SILT FENCE

A. Silt fence shall consist of a temporary vertical barrier of fabric attached to and supported by woven wire and wood or steel posts and entrenched into the ground. Only silt fence fabric on the MNDOT approved product list shall be allowed.

2.6 EROSION CONTROL WATTLES

A. Wattles shall consist of grain straw free of noxious weed seeds compressed and stuffed into a netting. Fibers shall be curled with soft, interlocking barbs to form a strong, organic filtration matrix. A minimum of 80% of the fibers shall be 6-inches or greater in length. Denisity of the wattles shall not exceed 2.6 lbs/cubic ft. The diameter shall be as shown on the Plans at a minimum of 9-inches.

B. Acceptable products produced by Curlex Sediment logs or equivalent.

2.7 TURF REINFORCEMENT MAT

A. Turf reinforcement matting shall consist of a permanent (Rolled Erosion Control Product) comprised of a synthetic fiber blend matrix mechanically (stitch) bound between two, UV stable heavy duty synthetic nets (top and bottom) with an expected longevity greater 36 months. The turf reinforcement mat shall be PP5-8 as manufactured by Western Excelsior Corporation, or Engineer “approved equal.” The matting shall satisfy of the following additional requirements:

1. Consist of synthetic fiber matrix confined between two UV stable, heavy duty synthetic nets,
2. Possess sufficient tensile strength, thickness and coverage to maintain integrity during installation and ensure material performance,
3. Provide permanent turf reinforcement with longevity greater than three years,
4. Possess immunity from moisture damage or chemical conditions within the soil,
5. Listed with AASHTO NTPEP database, and.
6. Meet ECTC specification for category 5B product.

B. The matting shall meet the following performance requirements:

Tensile Strength:	20.8 (MD) lb/in 17.7 (TD) lb/in
Elongation:	30 (MD) % 20 (TD) %
Mass per Unit Area:	8.0 oz/yd2
Thickness:	8.6 mm
Light Penetration:	15 - 35 %
Resiliency:	89%
UV Stability:	90%
Porosity:	95%

C. The netting shall meet the following performance requirements:

Top Net:	Synthetic, UV Stable
Bottom Net:	Synthetic, UV Stable
Top Net Opening:	0.50 - 0.75 in. x 0.50 - 0.75 in. (Nominal)
Bottom Net Opening:	0.50 - 0.75 in. x 0.50 - 0.75 in. (Nominal)

D. The matting shall be secured to the surface in strict conformance with the manufacturers instructions. Staples used to hold the mat in place shall be 6” long by 1” crown, 11 gauge minimum industrial quality.

PART 3 EXECUTION

3.1 INSPECTION AND TESTS

A. Materials shall be subject to inspection and testing to determine if furnished in accordance with applicable Federal and State laws and are equal to the requirements stated in the PRODUCTS paragraph.

3.2 STORM SEWER INLET PROTECTION DEVICE

A. All devices shall be installed as shown on the Drawings or as directed by the Engineer. Sediment control at the inlets shall be constructed in accordance with MnDOT Standard plate or detail.

B. Maintenance of the devices will be performed by the Contractor during construction of the project. Once the project has been accepted by the Owner; Owner will maintain the devices if left in place.

3.3 TEMPORARY VEHICLE CONSTRUCTION ENTRANCE

A. Temporary vehicle construction entrance shall be constructed as shown in the detail on the Drawings.

B. Wherever construction vehicles enter onto paced public roads, provisions shall be made to prevent the transport of sediment (mud and dirt) by vehicles tracking onto the paved surface. It is recommended that coarse-aggregate rock surfacing be provided to keep most construction traffic from coming into contact with mud and dirt. In other words, stabilized access, parking, staging, and loading and unloading areas will reduce the likelihood that vehicles will come into contact with mud. Sites that have not voluntarily implemented these practices may be required to construct a stabilized vehicle tracking control device.

C. An entrance shall be constructed at locations of ingress/egress construction traffic. Whenever deemed necessary by the Engineer, wash racks shall be installed to remove mud and dirt from the vehicle and its tires before it enters onto public roads.

D. Whenever the sediment is transported onto a public road, regardless of the size of the site, the road shall be cleaned at the end of each day. Sediment shall be removed from roads by shoveling or sweeping and be transported to a controlled sediment disposal area. Street washing shall not be allowed until after sediment is removed in this manner. Storm sewer inlet protective measures shall be in place at the time of street washing.

E. The tracking control shall be maintained within one day of notification to sustain effectiveness in reducing tracking material.

3.4 CONCRETE WASHOUT AREA

A. Concrete washout area shall be constructed as shown on the erosion control plan sheets. The concrete washout area must have a clay liner as shown on the Drawings.

B. Maintenance: Concrete washout area will require the removal of the accumulated sediment and liquids as necessary to prevent discharge of liquids from the concrete washout area.

3.5 EROSION CONTROL BLANKET

A. Erosion control blanket shall be applied per manufacturer’s instruction to all areas shown on the plans or designated by the Engineer.

3.6 SILT FENCE

A. Silt fence shall be in place at locations designated on the plans or at locations selected by the Engineer before earth disturbing activities have begun. Exceptions are at those areas where it is impractical to do so because of interference with construction activities. These exceptions must be approved by the Engineer. When a trench cannot be dug, 30 to 40 pound sand bags may be used to prevent underflow at the bottom of the silt fence. Silt fence shall be constructed according to the plans. The apparent opening size (AOS) is a designation that determines the permittivity of the fabric, as the AOS increases the opening size decreases.

3.7 EROSION CONTROL WATTLE

A. Erosion control wattles shall be applied per manufacturer's instruction to all areas shown on the plans or designated by the Engineer.

B. Contractor and Engineer shall inspect the erosion control wattles once every week and within 24-hours after every rain event greater than ½". The Contractor shall remove, dispose, or reshape the accumulated sediment when necessary as determined by the Engineer.

C. All costs for sediment removal, disposal or necessary shaping as directed by the Engineer along with all costs for removing the erosion control wattle from the Project shall be incidental to the Contract Unit Price per foot for "Erosion Control Wattle".

3.8 TURF REINFORCEMENT MAT

A. Turf reinforcement mat shall be applied per manufacturer's instruction to all areas shown on the plans or designated by the Engineer.

END OF SECTION

SECTION 321132 - AGGREGATE BASE COURSES

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 of the specifications includes the following:

1. Construction of all base course.
2. Geotextile Fabric.
3. Geosynthetic Geogrids.

B. Related Sections include the following:

1. Section 311000 “Site Clearing” for temporary erosion and sedimentation control measures, site stripping, stripping and stock piling topsoil, and removal of above - and below - grade improvements and utilities.
2. Section 312300 “Trenching Excavation and Backfilling” for soil materials, excavating, and backfilling.
3. Section 312000 “Earth Moving” for soil materials, excavating, and site grading.
4. Section 321216 “Plant Mixed Bituminous Pavement” for removal of existing bituminous surface, materials, job mix formula, testing, and placement.
5. Section 321613 “Concrete Curb and Gutter, Valley Gutter and Fillet Section” for concrete mix design, testing, and placement.

1.3 DEFINITIONS

A. Base Course-Class V: Crushed aggregate course placed on top of the subbase course on prepared surface receiving asphalt concrete or PC concrete surface.

B. Surfacing Course: crushed aggregate course placed.

C. Select Granular Material: Pit run material placed on prepared subgrade.

D. Geotextile Fabrics: Geotextiles are permeable fabrics which, when used in association with soil, have the ability to separate, filter, stabilize, or drain. Typically made from synthetic polymers, geotextile fabrics come in two basic forms: woven and non-woven.

E. Geosynthetic Geogrid: A polymeric grid formed by a regular network of integrally connected, multi-directional tensile elements of appropriate orientation, size and shape with triangular apertures of appropriate size and shape to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement.

1.4 STANDARD SPECIFICATIONS REFERENCE

A. The work to be performed under this Contract shall be governed by the Minnesota Department of Transportation “Standard Specifications for Construction”, Current Edition, which specifications shall apply as though printed in full with these Contract Documents.

B. Any reference to State, State of Minnesota, or Department of Transportation with regard to work or services to be completed or furnished shall be taken to mean the Clinton Graceville Beardsley School District, herein referred to as Owner, for purposes of this project.

C. Any reference to the Engineer shall mean the firm of Banner Associates, Inc., Consulting Engineers, Brookings, South Dakota, for the purpose of this project.

D. Mn/DOT Section 2211, Aggregate Base, shall apply to the construction of one or more courses of Contractor certified aggregate base on a prepared subgrade, except as modified herein.

1. Compaction shall be obtained by the Specified Density Method.
2. Aggregate base of each class shall be measured as indicated by Mass, (ton).

1.5 TESTING AND INSPECTION

A. Testing and Inspection Service: The Contractor shall secure the services of an approved independent geotechnical testing laboratory to perform the following tests and observations:

1. Gradations.
2. Densities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Base Course: The aggregate for Base Course shall consist of sound durable particle of gravel and sand, with which may be included limited amounts of fine soil particles.

1. Base shall be crushed aggregate conforming to MnDOT Class 5 requirements for Specification 3138.

B. Surfacing Course: The aggregate for Surfacing Course shall be a crushed aggregate conforming to MnDOT Class 2 requirements for Specification 3138.

C. Select Granular Material: The physical characteristics and quality of materials shall conform to the MnDOT requirements for Specification 3149.2-B Select Granular Borrow.

PART 3 EXECUTION

3.1 BASE COURSE

A. Base course materials may be processed by either road mix methods or plant mix methods.

B. When blending of ingredients is accomplished by road mix methods, granular additives shall be incorporated by means of an approved spreader box or other suitable device. Base course which is dumped on the project shall be satisfactorily windrowed prior to incorporating additives.

C. When blending of ingredients is accomplished by means of a central plant, the component materials (including water) shall be fed uniformly into the mixer of the plant at a predetermined rate of each material. The plant shall be equipped with control gates or devices to assure positive proportioning of separately piled or produced materials and the mixer shall thoroughly mix the materials.

D. When base course is laid by means of an approved spreader, it shall have been previously processed by means of a central plant.

E. When base course is laid by means other than an approved spreader, the quantity of material in the windrow will be limited to that necessary to construct a compacted layer with a four (4) inch thickness.

F. Each layer shall be satisfactorily compacted before the next lift is placed thereon.

G. The moisture content for compaction of base course shall be approximately optimum moisture of the material.

H. The required density of the constructed base course shall comply with Section 31 2000, Compaction of these Specifications. It shall be the responsibility of the Contractor to obtain test results showing the moisture-density relationship (Standard Proctor) of a representative sample of materials to be used for base course. The contractor shall be responsible for Proctors Tests due to changes of material. Such tests shall be conducted by an independent testing laboratory.

1. The Contractor shall employ an Independent Testing Laboratory to perform field in-place density tests according to ASTM D1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, refer to the calibration curves furnished with the moisture gages according to ASTM D 3017. A schedule of density tests may be submitted to the Engineer for approval.
2. Payment for these tests shall be made at the Contract unit price for “Compaction - Moisture/Density Tests”.
3. When testing agency reports that base course is below specified density, scarify and moisten or aerate, or remove and replace base course material to the depth required, recompact and retest until required density is obtained. All costs for reworking and retesting materials in areas of failed tests shall be the responsibility of the Contractor.
4. Copies of all test results shall be provided to the Engineer.

I. When the base course surface is to be primed, the final rolling of the top surface of the base course shall be accomplished in such a manner as will imbed as many of the loose stones as possible.

J. Temporary Surfacing: Excess gravel base course shall be placed to provide temporary surfacing. The gravel base shall be overfilled in all areas requiring permanent surfacing to provide drainage and driving transition.

3.2 SUBBASE COURSE

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Shape subbase course to required crown elevations and cross-slope grades.
2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.
4. No surface course shall be placed on the subgrade until the subgrade has been approved by the Engineer.

3.3 GEOTEXTILE FABRIC

A. Geotextile Fabric shall be installed in strict conformance with AASHTO M288 and the manufacturer's recommendation. In the case of a conflict between the two, the more stringent shall take precedence. The Contractor shall take care when removing the subgrade material(s) such that no excessive traffic and/or heavy equipment is placed on the soft material. The layout of fabric and placement of subbase aggregate should keep pace with the excavation to limit groundwater/surface water from ponding on the subgrade.

B. Fabric overlaps and seams shall be completed in accordance with AASHTO M288 and the manufacturer's recommendations. In the case of a conflict between the two, the more stringent shall take precedence. Vehicles/equipment shall not be allowed to drive directly on the fabric. If the fabric is damaged during installation, the damaged section shall be exposed and a patch of fabric placed over it. The patch should be large enough to overlap onto unaffected areas by 3 to 4 feet.

3.4 GEOSYNTHETIC GEOGRID

A. The Contractor shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the Contractor to be free or flaws or damage occurring during manufacturing, shipping, or handling.

B. The Subgrade soil shall be prepared as indicated on the construction drawings or as directed by the Engineer.

C. The geogrid shall be laid at the proper elevation and alignment as shown on the construction drawings.

D. The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the Engineer.

E. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the Engineer.

F. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.

G. A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber-tired equipment may pass over the geogrid reinforcement as slow speeds (less than 10 mph) when integrally-formed geogrids are used. When woven, multi-layer or welded-strip geogrids are used, rubber-tired equipment shall not be allowed directly on the geogrid. Sudden braking and sharp turning movements shall be avoided.

H. Any damaged or defective (i.e. frayed coating, separated junctions, separated layers, tears, etc.) will be repaired/ replaced in accordance with Section 3.3.I and Section 3.3.J.

I. Any roll of geogrid damaged before, during the after installation shall be replaced by the Contractor at no additional cost to the Owner.

J. Proper replacement shall consist of replacing the affected area adding 3ft (1m) of geogrid to either side of the affected area.

K. Follow the Manufacturer's recommendations regarding protection from exposure to sunlight.

END OF SECTION

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SECTION 321216 - PLANT MIXED ASPHALT PAVEMENT

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 of the specifications includes the following:

1. Roadway surfacing.

B. This is a Certified Plant Project. The supplier shall have sufficient testing facilities and qualified personnel including Certified Technicians. If requested by the Engineer, the required tests shall be performed in a timely manner and with a good quality control program.

C. Related Sections include the following:

1. Section 321132 “Base Courses” for aggregated materials, geotextile fabric, testing, and placement.

1.3 STANDARD SPECIFICATIONS REFERENCE

A. The work to be performed under this Contract shall be governed by the Minnesota Department of Transportation “Standard Specifications for Construction”, Current Edition, which specifications shall apply as though printed in full with these Contract Documents.

B. Any reference to State, State of Minnesota, or Department of Transportation with regard to work or services to be completed or furnished shall be taken to mean the Clinton Graceville Beardsley School District, herein referred to as Owner, for purposes of this project.

C. Any reference to the Engineer shall mean the firm of Banner Assoc. Inc., Consulting Engineers, Brookings, South Dakota, for the purpose of this project.

D. Mn/DOT Section 2360, Plant Mixed Asphalt Pavement, shall apply to the construction of plant-mix bituminous surfacing, except as modified herein.

1. Mn/DOT Section 2360.3D: The maximum payment factor for density is 100%.
2. MN/DOT Section 2360.7E (pavement smoothness) is hereby DELETED. Surface smoothness shall be +/- 1/8-inch in 10 feet measured in any direction.
3. Mn/DOT Section 2357 shall apply to the construction of bituminous tack coat, except as modified herein.
4. The Contractor shall submit a Quality Control plan to the Engineer at the preconstruction meeting.
5. Reduction in payment for asphalt concrete courses shall be enforced for in-place density and thickness as noted herein.

E. Unless noted otherwise, the provisions in this Section are in addition to the referenced specification.

1.4 QUALITY CONTROL TESTING

A. The Contractor shall secure the services of an approved independent geotechnical testing laboratory to perform the following tests and observations:

1. Asphalt Densities.
2. Layer Thickness.

B. The independent testing laboratory conducting the tests specified above shall not be the same conducting the Contractor's required quality tests.

C. Testing of the material Bituminous Tack may be required, if determined by the Engineer, that the material appears suspect.

D. Cores for testing shall be taken preferably 12 but no later than 48 hours after paving operations.

1.5 CONTRACTOR SUPPLIED MIX DESIGN

A. The Contractor shall submit the mix design in accordance with MnDOT Specification 2360.1/2360.2 and other requested applicable information to the Engineer for approval a minimum of two weeks prior to commencing paving operations. A current Mn/DOT mix design may be accepted provided it represents the aggregate source and bituminous being used for the project and is approved by the Engineer. No bituminous mixture shall be placed without an approved mix design.

1.6 SEQUENCING AND SCHEDULING

A. The Contractor shall submit a paving schedule / plan addressing longitudinal seams, compaction, traffic control and hauling routes to the Engineer for approval prior to placement of each bituminous course (lift).

B. As required by Contract, aggregate base to be completed and approved by the Engineer prior to placement of bituminous surfaces.

C. As required by contract, Contractor shall adjust structures prior to placement of bituminous wearing course.

D. The Contractor shall provide a 48-hour notice for scheduling and noticing of the residents prior to paving operations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mineral Aggregates: Aggregates for central plant hot mix shall conform to Mn/DOT Section 2360.2A and Section 3139.

1. Central plant hot mix aggregate shall be crushed stone or crushed gravel and approved mineral filler, where required. The aggregate shall not contain clay balls or organic debris and the particles shall be substantially free from coating with clay or dust which prevents thorough coating with asphalt.

a. Mineral aggregate used for the wear course shall conform to Mn/DOT Section 3139 for Class A.
b. Mineral aggregate used for the non-wear course shall conform to Mn/DOT Section 3139 for Class A.

B. Bituminous Material: Asphalt material for central plant hot mix, tack coat, and seal coat shall conform to the requirements of Mn/DOT Sections 2360.2G, 3151.2A, 3151.2C, and 3151.2D of the referenced Specifications.

1. Performance graded asphalt binder for central plant hot mix shall be PG 58S-28, conforming to AASHTO Performance Graded Binder Specifications, M 320 and the Combined State Binder Group Method of Acceptance for Asphalt Binder.
2. Asphalt for tack shall be an anionic emulsified asphalt SS-1H conforming to AASHTO M 140 or cationic emulsified asphalt CSS-1H conforming to AASHTO M208. The use of cutbacks or emulsions that contain solvents shall not be permitted.

C. No recycled materials will be allowed in the bituminous wear course.

2.2 MIXES

A. Plant Mixed Asphalt: Central plant hot mix shall be composed of a mixture of aggregate and asphalt cement as specified above. The aggregate fractions and the asphalt cement shall be combined in such a manner that the resulting composite blend meets the requirements of the job-mix formula.

1. The Contractor shall submit for the Engineer's approval a job-mix formula for the mixture to be furnished for the project prior to placing any asphalt concrete pavement for payment. The job-mix formula shall establish a single percentage of bituminous material to be added to the aggregate, a single temperature at which the mixture is to be emptied from the mixer, and a single temperature at which the mixture is to be delivered to the bituminous paver.

a. The job mix formula shall be a Marshall Design Mix.
b. The following mixes are called for in the plans:

1) SPNWA230B.
2) SPWEA240B.

PART 3 EXECUTION

3.1 REMOVAL OF SURFACE IMPROVEMENTS

A. Saw Cutting Pavement: When it is necessary to cut through asphalt concrete pavement before excavating a trench, the cut shall first be made with a concrete saw for the full depth of the existing surface. The width of the pavement removed shall be twelve (12) inches wider than the trench excavation to provide a shoulder on each side. After the edges have been cut, the area to be removed shall be broken into small pieces and the material removed and disposed of as directed by the Engineer.

B. If the sawed edge has been damaged and is not vertical due to subsequent construction activities, such as trench backfilling, placement of base course, traffic, etc., the Contractor shall make another cut parallel to and no less than six inches away from the initial cut immediately prior to paving.

C. The saw cutting of asphalt concrete pavement shall be incidental to asphalt.

3.2 BITUMINOUS PAVEMENT

A. Construction Requirements: The construction of all courses shall be in compliance with Mn/DOT Section 2360.3 of the referenced Specifications.

B. Surface Preparation.

1. Sweep paved surfaces with power pickup broom.
2. Adjust and protect structures as necessary.

C. Joints: Where new construction meets existing bituminous surfacing, the existing surface shall be uniformly milled or saw-cut straight, and bituminous tack coat applied prior to placement or each bituminous course (lift). For joint construction, an existing bituminous surface shall be considered to include any bituminous surface not paved on the same day as the new construction. The Owner may require milling or saw-cutting on surfaces paved the same day, if, in the opinion of the Owner, the mix has cooled to a point where a new milled or sawed edge is necessary. Asphalt construction joints shall not be placed in the wheel path of traffic. Joint pattern shall be approved by Engineer before construction. Longitudinal Joints:

1. Rolling operations for confined edges, the first pass adjacent to the confined edge, the compaction equipment shall be entirely on the hot mat from the longitudinal joint.
2. Rolling operations for un-confined edges, the compaction equipment shall extend 6” beyond the edge of the mat.
3. Longitudinal joints of succeeding lifts should be offset approximately 6”.
4. Longitudinal joints should be on the lane lines in the top lift. A paving plan will be required from the Contractor.

D. Restrictions: In general, no work within the roadway will be permitted in the spring until seasonal load restrictions on roads in the vicinity have been removed.

1. HMA shall not be placed when, in the opinion of the Engineer, the weather or roadbed conditions are unfavorable.

2. No asphalt pavement wearing course shall be placed after October 15th in that part of the state north of an east-west line between Browns Valley and Holyoke, nor after November 1st South of that line.
3. The Contractor shall not use petroleum distillates such as Kerosene and fuel oil to prevent adhesion of asphalt mixtures.
4. Seasonal Limitations:

    a. Bituminous composite will not be laid if the underling surface is wet or frozen.
    b. Temperature for lower lifts shall be, at minimum, 35 degrees Fahrenheit, with a forecast of holding or rising temperatures.
    c. Temperatures for top list shall be, at minimum 40 degrees Fahrenheit, with a forecast of holding or rising temperatures.
    d. The Engineer may require tarping of loads during cool or windy conditions.

E. Equipment: Asphalt mixing plants, binder control, dryer, thermometric equipment, pollution controls, surge and storage bind, pavers, trucks and hauling equipment shall comply with Mn/DOT Section 2360.3 of the referenced Specifications.

F. Treatment of the Surface: An asphalt tack coat shall be applied in conformance with Mn/DOT Section 2360.3B3 of the referenced Specifications.

G. Compaction Operations: After being spread, each course shall be compacted to the required density in accordance with Mn/DOT Section 2360.3D of the referenced Specifications.

1. Compaction shall be in accordance with Maximum Density Method.

3.3 FIELD QUALITY CONTROL

A. The maximum payment factor for density is 100%.

1. Reduction in payment for asphalt concrete courses constructed to less than permissible in-place density shall be as follows:

Payment Schedule for In-Place Density	
Percent of In-Place Density	Percent Payment
92.0 and above	100
91.0-91.9	98
90.5-90.9	95
90.0-90.4	91
89.5-89.9	85
89.0-89.4	70
< 89.0 (1)	50 or Remove/Replace (1)

2. Contractor shall remove and replace the unacceptable material at their expense with acceptable material or the Engineer may permit the unacceptable material with a 50% payment factor.

B. Bituminous Thickness Requirements:

1. After compaction, the thickness of each lift shall be within ¼-inch of the thickness shown in the Plans.
2. Any lift constructed to more than the maximum permissible thickness; the excess material placed above Plan thickness plus ¼-inch may be excluded from the pay quantities.
3. A $0.50 deduction per square yard-inch will be made for each ¼-inch deficiency of thickness beyond the specified tolerances.

C. Testing:

Quantity Mixture Type	REQUIRED CONTRACTOR TESTING			
	VMA % Air Voids	Gradation	Spot Check	Extraction
0-250 Ton	1	1	1	1
250-500 Ton	2	1	1	1
500 + Ton	2 First Day 1/1000 Ton Thereafter, With Min. 2/day	1/Day	1/Day	1

1. Contractor shall provide a copy of the testing results to the Engineer on a daily basis.
2. Should any of the specified tests fail, the Contractor shall notify the Engineer immediately and shall arrange and pay for additional test as may be necessary to satisfy the Engineer that the requirements have been met.
3. Cost for daily production testing shall not be paid for separately but shall be included in the price for “Plant Mixed Asphalt Pavement”.

END OF SECTION

SECTION 321613 - CONCRETE CURB AND GUTTER, VALLEY GUTTER AND FILLET SECTIONS

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 of the Specifications includes following:

1. Concrete curb and gutter.
2. Concrete fillet sections.
3. Concrete valley gutter.
4. Concrete paving.

B. This is a Certified Plant Project. The supplier shall have sufficient testing facilities and qualified personnel including Certified Technicians. If requested by the Engineer, the required tests shall be performed in a timely manner and with a good quality control program.

C. Related Sections include the following:

1. Division 31; Section “Site Clearing” for site stripping, stripping and stock piling topsoil, and removal of above - and below - grade improvements and utilities.
2. Division 31; Section “Trenching Excavation and Backfilling” for soil materials, excavating, and backfilling.
3. Division 31; Section “Earth Moving” for soil materials, excavating, and site grading.
4. Division 32; Section “Base Courses” for aggregated materials, testing, and placement.
5. Division 32; Section “Plant Mixed Bituminous Pavement” for removal of existing bituminous surface, materials, job mix formula, testing, and placement.

1.3 STANDARD SPECIFICATION REFERENCE

A. The work to be performed under this Contract shall be governed by the "Standard Specifications for Construction", Minnesota Department of Transportation, Current Edition, which specifications shall apply as though printed in full with these Contract Documents.

B. Any reference to the Engineer shall mean the firm of Banner Associates, Inc., Consulting Engineers, Brookings, South Dakota, for purposes of this project.

C. MnDOT Specification Section 2301, Concrete Pavement shall apply to the construction of Concrete Pavement except as modified herein.

D. MnDOT Specification Section 2531, Concrete Curb and Gutter shall apply to the construction of Curb and Gutter except as modified herein.

1.4 TESTING

A. All tests of cement, aggregates and concrete shall be made by a testing laboratory, approved by the Engineer, and at the expense of the Contractor. The Contractor shall furnish reports of all concrete tests from the testing laboratory. Two (2) copies of such reports shall be sent as promptly as possible to the Engineer. No concrete shall be placed for payment prior to the Engineer approving the P.C.C. mix design. It shall be the Contractor's responsibility to cause all specimens and tests to be made in accordance with these Specifications under the direct supervision of the Engineer and at no additional cost to the Owner.

1. Advance Concrete Tests: If the source of material is not familiar to the Engineer, advance tests will be required. A minimum of six (6) standard compression test cylinders shall be made in the proportions and from materials proposed to be used in the major portion of the project. The slump of the concrete used in making these cylinders shall not be less than the greatest slump expected to be used on the work. These test cylinders shall be made in accordance with ASTM Standards. Half of the cylinders shall be tested at an average of seven (7) days, which shall be prior to commencing concrete construction, as a check on the specified strength, and the other half shall be tested at an age of twenty-eight (28) days. No concrete shall be placed in any structure until the seven (7) day age test has been made. If the seven (7) day age strength falls below the specified minimum, the Contractor shall redesign his mix and additional tests shall be made to check the revised design. All advance tests shall be made at the expense of the Contractor. The testing laboratory shall furnish the Engineer with a Design Comprehensive Strength Curve based on the results of the advanced tests. Curve shall be strength (psi) versus time (in days) as ordinate and abscissa, respectively.
2. Field Concrete Tests:

a. Making and Curing Compression Test Specimens:

1) During the progress of the work compression test specimens shall be made and cured in accordance with the "Standard Method of Making and Curing Concrete Test Specimens in the Field" (ASTM C 31). Each test shall consist of at least four (4) specimens. Not less than one test shall be made for each strength of concrete placed on any one day and at least one test for each pour of 100 cubic yards of concrete or fraction thereof placed. The Contractor shall have the testing laboratory make additional sets of tests as directed by the Engineer at no cost to the Owner.
2) Specimens shall be cured under laboratory conditions except that when, in the opinion of the Engineer, there is a possibility of the surrounding air temperature falling below 40F., he may require additional specimens to be cured under job conditions.
3) All field cylinders shall be made and cured by an independent testing laboratory, approved by the Engineer, and at the expense of the Contractor.
4) The Contractor shall have available at the job site sufficient approved molds for making the required test cylinders.

b. Test for Compression Strength:

1) Specimens shall be tested in accordance with the "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens" (ASTM C 39). For each test, one specimen shall be tested at the age of 7 days and two specimens

shall be tested at the age of 28 days. Tests shall be made by an approved independent Testing Laboratory. Two copies of the test reports shall be submitted to the Engineer.

2) The average of any five consecutive strength tests of the laboratory cured specimens representing each class of concrete shall be equal to or greater than the specified strength and not more than 20% of the strength tests shall have values less than the specified strength.
3) When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete mix proportions for the remaining portion of the structure, sufficient to increase the strength to meet these requirements. The strengths of the specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Engineer, the strengths of the job-cured specimens are excessively below those of the laboratory-cured specimens the Contractor may be required to improve the procedures for protecting and curing the concrete.
4) In addition, when concrete fails to conform to the requirements of Paragraph 2.b.2 when tests of field-cured cylinder indicate deficiencies in protection and curing, the Engineer may require tests in accordance with "Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" (ASTM C 42) or order load tests for that portion of the structure where the questionable concrete has been placed.

c. Tests for Slump: Slump tests shall be made according to "Standard Test Method for Slump of Portland Cement Concrete" (ASTM C 143).

    1) A minimum of one (1) slump test shall be taken for each daily concrete pour less than 100 cubic yards. If more than 100 cubic yards is placed per day, then one test shall be taken for each 100 cubic yards or fraction thereof placed. The Contractor shall have the testing laboratory make additional sets of tests as directed by the Engineer at no cost to the Owner. The slump test(s) shall be made by an independent testing laboratory, approved by the Engineer, and at the expense of the Contractor. Two (2) copies of the Report shall be submitted to the Engineer.

d. Tests for Air Content: Air content of concrete shall be tested according to either "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method" (ASTM C231) or "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method". (ASTM C 173).

    1) A minimum of one (1) air content shall be taken for each daily concrete pour less than 100 cubic yards. If more than 100 cubic yards is placed per day, then one test shall be taken for each 100 cubic yards or fraction thereof placed. The Contractor shall have the testing laboratory make additional sets of tests as directed by the Engineer at no cost to the Owner. The air content test(s) shall be made by an independent testing laboratory, approved by the Engineer, and at the expense of the Contractor. Two (2) copies of the Report shall be submitted to the Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete: Concrete shall conform to Section 2461 of the Standard Specification.

B. Reinforcement: Reinforcing bars shall conform to Section 3301 of the Standard Specifications.

C. Expansion Joint: Expansion joint material shall be bituminous type preformed expansion joint filler conforming to the requirements of Section 3702 of the Standard Specifications.

D. Hot Pour Joint Sealant: Hot Pour joint sealant shall conform to Section 3725 of the Standard Specifications.

E. Silicone Joint Sealant: Polyurethane joint sealant shall conform to Section 3722 of the Standard Specifications.

F. Gravel Cushion: The aggregate for Gravel Cushion shall be crushed aggregate conforming to MNDOT Class 5 for aggregate base course gradation requirements.

2.2 CONCRETE MIX DESIGN

A. Mix Design: The contractor shall submit at least 30 days prior to the start of placing curb and gutter approval, a job-mix formula for the mixture to be furnished for the project. The job-mix formula shall be proportional for the maximum slump to be used on the project.

1. The job-mix formula shall conform to Section 2461 of the Standard Specifications for the following:

a. Concrete curbs and gutters - Mix Design Slipform Placement, 3F32.
b. Fillet Section - Mix Design 3F52.
c. Valley gutter - Mix Design 3F52.
d. Concrete Sidewalk and Pavement - Mix Design 3F52.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation shall be in accordance with Section 31 2000 of these Specifications.

3.2 FORMS

A. Forms shall be of metal free from warp and of such construction that there will be no interference with inspection of grade and line. All forms shall extend for the entire depth of the

concrete and shall be braced and secured sufficiently that no deflection from alignment will occur during placing of concrete and shall be tight enough to prevent the leakage of concrete.

B. In lieu of construction using fixed side forms, concrete may be placed and formed to the required shape by using an approved type of extrusion machine that will produce a finished product meeting the standards as would be achieved with fixed-form construction. When machine placement is used, the Engineer may permit modification of consistency requirements to achieve optimum results.

3.3 PLACEMENT

A. Concrete shall be placed and compacted in the forms without segregation. While concrete is still plastic the curb, fillet and valley gutter sections shall be formed by screeding between templates by means of a straight edge or extruded longitudinally be means of an approved forming machine.

3.4 FINISHING

A. The exposed surfaces shall be finished smooth and even. Edges of gutter, fillet and valley gutter and top face edges of curb, fillet and valley gutter shall be finished with an approved finishing tool having a radius as shown on the drawings. Top surfaces shall be brushed or broomed to slightly roughen the surface and remove the finishing tool marks.

3.5 JOINTS

A. Expansion Joints shall be placed transversely, at radius points; at each junction with existing concrete curbs, gutters, buildings, structures, expansion joints in adjacent existing concrete or at locations directed by the Engineer.

B. Expansion Joints shall be placed longitudinally, along the back face of the curb and fillet, to the depth of the sidewalk, where such back face of curb is adjacent to an existing concrete sidewalk, along buildings and structures, or at locations directed by the Engineer.

C. Weakened Plane joints shall be constructed at ten (10) foot intervals in continuous runs or match to adjacent concrete pavement. The joints shall be formed or cut one-eighth (1/8) inch wide to a minimum depth of one (1) inch. Edges of joints, except saw cuts, shall be tooled prior to final finish.

3.6 CURING

A. Concrete shall be protected and cured in accordance with Section 2531 of the Standard Specifications.

3.7 DAMAGE TO EXISTING CONCRETE SURFACING AND CURB AND GUTTER

A. Damage to Existing Concrete Surfacing and Curb and Gutter that is not indicated to be replaced on the Drawings shall be replaced by the Contractor at no cost to the Owner.

END OF SECTION

SECTION 321723 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section of the specifications includes the following:

1. Pavement Markings.

1.3 STANDARD SPECIFICATIONS REFERENCE

A. The work to be performed under this Contract shall be governed by the "Standard Specifications for Construction", Minnesota Department of Transportation, Current Edition, which specifications shall apply as though printed in full with these Contract Documents.

B. Any reference to the Engineer shall mean the firm of Banner Associates, Inc., Consulting Engineers, Brookings, South Dakota, for purposes of this project.

C. MnDOT Specification Section 2582, Pavement Markings shall apply to the construction of Pavement Markings except as modified herein.

PART 2 PRODUCTS

2.1 HIGH BUILD WATERBOURNE PAVEMENT MARKING PAINT

A. Pavement Marking Paint: Provide reflectorized white and yellow multi-component, 100 percent solids multi-component liquid pavement markings meeting the requirements of Section 3590.

1. Color: Yellow.
2. Color: White.

PART 3 EXECUTION

3.1 PAVEMENT MARKING PAINT AND BEADS

A. Application of Pavement Marking Paint and Beads shall conform with the Standard Specifications Section 2582.3.

B. Pavement Marking Paint and Beads: Pavement marking paint shall be applied by machine. On special areas and markings that are not adaptable to machine application, hand application will be permitted.

C. The paint shall be used as furnished by the manufacturer. Thinner or diluent shall not be added. Filling tanks, pouring paint, or cleaning of equipment shall not be allowed on the pavement.

D. The pavement marking shall be applied during daylight hours when the ambient air temperature is above 45°F and the road surface is dry. The pavement shall be cleaned of dirt, loose stones, and other foreign material before the paint is applied.

E. The paint applicator shall be a self-propelled spraying machine with nozzles capable of applying a minimum of three lines at one time, each gun applying 4 to 8 inches wide.

F. During pavement marking operations on sections of roadway open to traffic, the Contractor shall protect the markings from tracking either by placing suitable traffic control devices or by utilizing a shadow vehicle. The work shall be arranged such that half of the traveled roadway will be open to traffic at all times.

G. The Contractor shall take the steps necessary to assure that the permanent pavement markings will match the markings on the existing surface.

H. All Symbols shall be placed as listed in this specification and the Standard Specifications.

I. The Contractor shall sweep the street within 24 hours prior to the application of the paint.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain-link fence framework.
2. Chain-link fittings.
3. Chain-link wires and ties.
4. Chain-link swing gates.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete for post footings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
b. Fence and gate posts, rails, and fittings.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, ground details, post spacing, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Delegated Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence and gate.

B. Product Test Reports: For framework strength in accordance with ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five 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 chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks are to withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated in accordance with ASCE/SEI 7.

1. Design Wind Load: As required per manufactures standard recommendations.

a. Minimum Post Size and Maximum Spacing: Determine in accordance with CLFMI WLG 2445, based on mesh size and pattern specified.

C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

D. Accessibility: Pedestrian gates to comply with the United States Access Board's ADA-ABA Accessibility Guidelines.

2.2 CHAIN-LINK FENCES, GENERAL

A. CLFMI Publications: Comply with the CLFMI Product Manual unless modified by requirements in the Contract Documents.

B. Chain-Link Fence and Gate Assemblies: Include materials applicable for a complete assembly of application types, consisting of commercial, industrial, and security chain-link fences and gates.

1. Source Limitations: Obtain chain-link fence and gate components from single source or manufacturer.

2.3 CHAIN-LINK FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thicknesses in accordance with ASTM F1043 based on the following:

1. Fence Height: 48 inches (1220 mm).
2. Horizontal Framework Members: Intermediate top and bottom rails in accordance with ASTM F1043.

a. Top Rail: 1.66 inches (42 mm).

3. Metallic Coating for Steel Framework:

a. Type A: Not less than minimum 2.0 oz./sq. ft. (0.61 kg/sq. m) average zinc coating in accordance with ASTM A123/A123M or 4.0 oz./sq. ft. (1.22 kg/sq. m) zinc coating in accordance with ASTM A653/A653M.
b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.
d. Coatings: Any coating above.

4. Polymer coating over metallic coating.

a. Color: As selected by Architect from manufacturer's full range, in accordance with ASTM F934.

2.4 CHAIN-LINK FITTINGS

A. Provide fittings in accordance with ASTM F626.

B. Post Caps: Provide for each post.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Tie Wires, Clips, and Fasteners: In accordance with ASTM F626.

E. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of zinc.

a. Polymer coating over metallic coating.

2. Aluminum: Mill finish.

2.5 CHAIN-LINK WIRE AND TIES

A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire in accordance with ASTM A817 or ASTM A824, with the following metallic coating:

1. Type II: Zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:

a. Class 3: Not less than 0.8 oz./sq. ft. (244 g/sq. m) of uncoated wire surface.

B. Polymer-Coated Steel Wire: 0.148-inch- (3.8-mm-) diameter, tension wire in accordance with ASTM F1664, Class 1 over zinc-coated steel wire.

1. Color: As selected by Architect from manufacturer's full range, in accordance with ASTM F934.

C. Aluminum Wire: 0.192-inch- (4.88-mm-) diameter tension wire, mill finished, in accordance with ASTM B211 (ASTM B211M), Alloy 6061-T94 with 50,000-psi (344-MPa) minimum tensile strength.

2.6 CHAIN-LINK SWING GATES

A. General: ASTM F900 for gate posts and single and double swing gate types.

1. Gate Leaf Width: As indicated on drawings.
2. Framework Member Sizes and Strength: Based on gate fabric height of more than 72 inches (1830 mm.

B. Swing Gate Pipe and Tubing:

1. Swing Gate Posts: Round tubular steel.
2. Gate Frames and Bracing: Round tubular steel.
3. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.

C. Swing Frame Corner Construction: Welded or assembled with corner fittings.

D. Swing Gate Hardware:

1. Hinges: 180-degree outward swing.

2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Lock: Manufacturer's standard internal device.
4. Padlock and Chain: Owner to provide padlock and chains.
5. Closer: Manufacturer's standard.

2.7 CONCRETE

A. Concrete Post Footings: Minimum 28-day compressive strength of 2500 psi (17.2 MPa).

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION OF CHAIN-LINK FENCES

A. Install chain-link fencing in accordance with ASTM F567 and more stringent requirements specified.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Concealed Concrete: Place top of concrete 2 inches (50 mm) below grade to allow covering with surface material.

D. Terminal Posts: Install terminal end, corner, and gate posts in accordance with ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.

For runs exceeding 500 feet (152 m), space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

F. Tension Wire: Install in accordance with ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install in accordance with ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Bottom Rails: Secure to posts with fittings.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches (380 mm) o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric in accordance with ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

3.4 INSTALLATION OF GATES

A. Install gates in accordance with manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

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SECTION 329200 - TURF AND GRASSES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections apply to this Section.

1.2 SUMMARY

A. This section of the Specifications includes the following:

1. Seed Mix.
2. Fertilizer.
3. Mulch.
4. Hydro-mulching.

B. Related Sections include the following:

1. Section 311000 “Site Clearing” for temporary erosion and sedimentation control measures, site stripping, stripping and stockpiling topsoil, of above - and below - grade improvements and utilities.
2. Section 312300 “Trenching Excavation and Backfilling” for soil materials, excavating, and backfilling.
3. Section 312200 “Earth Moving” for soil materials, excavating, and site grading.
4. Section 312500 “Erosion and Sedimentation Controls” for erosion control blanket, silt fence, erosion bales, and placement of materials.

1.3 STANDARD SPECIFICATION REFERENCE

A. The Contractor shall meet all the requirements of the latest applicable laws/chapters of the Minnesota Department of Agriculture, or local governing laws.

B. The seeding work to be performed under this Contract shall be governed by the “Standard Specifications for Construction”, Minnesota Department of Transportation, 2018 Edition, which specifications shall apply as though printed in full with these Contract Documents.

PART 2 PRODUCTS

2.1 PERMANENT SEED MIXTURE

A. Seed shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations and shall be furnished in sealed containers. Labels shall indicate compliance with the Federal Seed Act.

1. Pure Live Seed (PLS) shall be determined using the following equation:

2. %PLS = %Germination x % Purity.
3. The PLS shall be used in the specified grass seed mixtures.

B. SEED MIX.

1. Sun & Shade Mix or Engineer approved equal shall consist of the following components at the rate of 6 lbs./1000 sq. ft.:

a. 60% Kentucky Bluegrass.
b. 25% Fine-Leaf Perennial Ryegrass.
c. 15% Creeping Red Fescue.

2.2 FERTILIZER

A. Fertilizer shall consist of an all-natural organic fertilizer 8-2-4 Sustane® or Engineer approved equal applied per manufacturer's recommendation. Fertilizer shall conform to State fertilizer laws, shall be granular or pelleted form and furnished in the manufacturer's labeled bags. Delivery containers shall be unopened delivery and the labels shall show grade furnished, in conformance with the State fertilizer laws.

2.3 MULCH

A. Mulch for hydro-mulching shall be produced from wood or recycled paper processed into a fibrous material. The fiber texture shall be sufficient to achieve an erosion resistant product which can be easily pumped with a hydro-mulching machine.

2.4 MYCOAPPLY SUPER CONCENTRATE

A. MycoApply Super Concentrate-1, mycorhizzal inoculum consisting of a 4 species blend of abruscular mycorrhizal fungi (endomycorrhizal fungi). Powder shall be seed applied and will be less than 220 microns in size. Concentration of this product is 1 million spores per pound.

PART 3 EXECUTION

3.1 INSPECTION AND TESTS

A. Materials shall be subject to inspection and testing to determine if furnished in accordance with applicable Federal and State laws and are equal to the requirements stated in the PRODUCTS paragraph.

3.2 SOIL PREPARATION & FERTILIZE

A. Topsoil previously placed on areas to be seeded shall be smoothed, then tilled to a depth of six inches. The soil shall be in a firm but uncompacted condition immediately in advance of the seeding operations. Vegetation and debris unearthed shall be removed. Fertilizer shall be incorporated uniformly into the soil to a depth of not more than 1 inch at the rate of 1 pound of available nitrogen and 1.5 pounds actual phosphate per 1000 sq. ft. for seeded areas or as

specified elsewhere on the Plans and Specifications. The surface of the seedbed shall conform to the established grades.

3.3 SEEDING & MULCHING

A. Permanent seeding shall not be done between June 15 and August 15 except as otherwise directed in writing by the Engineer.

B. Seed shall be sown by means of a disc drill. The drills shall be set for uniform rows not to exceed six inches apart. The seed shall be drilled in a depth of 3/4 to 1 inch. The seed shall be sown in two passes with the second pass perpendicular to the first. Broadcast sowing shall be permitted for only small areas and areas inaccessible to drills. The seed shall be lightly covered by harrowing or raking.

C. Hydro-Mulch shall be applied to all seeded areas in a uniform, continuous blanket at a rate of 2,000 lbs./acre. Mulch shall be installed on all disturbed areas receiving seed excluding those areas receiving an erosion control blanket.

D. Seeding Guidelines.

1. It is desirable to have at least 6” of black topsoil.
2. If weeds are a problem, apply a glyphosate product and allow weeds to burn down for at least 7 days prior to seeding.
3. Remove rocks and debris. Till the top 4”-6” of soil.
4. Firm up the seedbed by raking and/or roll packing. When walked on, you should not sink more than 1”.
5. Seed at the application rate as specified in this specification.
6. Spread 8-2-4 all-natural slow release fertilizer (Sustane®) at 10lb/ 1,000 sq. ft.
7. Hydro-Mulch Mat Fiber Plus® at 2,000 lbs/acre.
8. MycoApply Super Concentrate-1 apply at 1 lb/acre.

3.4 WATERING

A. Immediately upon completion of the mulching operation, the seeded areas shall be given one watering unless otherwise directed. Sufficient water shall be applied to penetrate the seedbed to a depth of two (2) inches. All watering shall be done in a manner which will provide uniform coverage, but which will not cause erosion or damage to the finished surface. Subsequent watering of seeded areas shall be in compliance with Maintenance; stated below.

3.5 MAINTENANCE

A. The seeded areas and trees to be replanted shall be watered as necessary, or as directed by the Engineer, and be maintained until all work in the entire contract or designated portions thereof have been completed and accepted. Maintenance shall consist of providing protection against traffic and of repairing any damage. Mulch material or erosion control blanket that has been dislodged by wind or from other causes shall be replaced and secured.

3.6 REPAIR

A. If at any time before completion and acceptance of the entire contract work, the seeded areas are damaged by erosion, trespass or other cause, the areas shall be repaired and reseeded, as originally specified. Contractor shall be responsible to ensure grass growth in all seeded areas. Any areas of insufficient grass growth shall be re-tilled, seeded, mulched or erosion control blanket installed, and watered by the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 331000 - WATER UTLITIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. The Section includes the following:

1. Water distribution pipe;
2. Water service pipe;
3. Water distribution/ service fittings;
4. Fire hydrants;
5. Valves and valve boxes; and.
6. Miscellaneous appurtenances.

B. Related Sections include the following:

1. Section 311000 “Site Clearing” for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above-and below-grade improvements and utilities.
2. Section 312300 “Trenching Excavation and Backfilling” for soil materials, excavating, and backfilling.
3. Section 312200 “Earth Moving” for soil materials, excavating, and grading.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. General: Pipe furnished for installation on this project shall be of size shown on the Drawings. The pipe shall be manufactured from one of the materials designated for specified line and application as shown in the following Subsections.

B. Class 235, C900 PVC Pipe:

1. Polyvinyl chloride pressure pipe and fittings shall conform to the requirements of AWWA C900 "Poly Vinyl Chloride (PVC) Pressure Pipe", Class 235 meeting the requirements of DR18.
2. Outside pipe diameter shall be the same as that of cast iron pipe of similar nominal size.
3. Pipe materials shall conform to "Standard Specification for Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds" (ASTM D-1784).
4. The pipe shall bear the National Sanitation Seal for potable water pipe.
5. Provisions must be made for expansion and contraction at each joint with an elastomeric ring.

6. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring which meets the requirements of ASTM D1869. The bell section shall be designed to be at least as strong as the pipe wall.
7. Each length of pipe, including integral bell, shall be pressured in accordance with AWWA C900 Standards.
8. Pipe and fittings must be assembled with a non-toxic lubricant.
9. Standard lengths shall be 20 feet for all sizes.
10. Pipe may be furnished with separate couplings in lieu of integral bell in order to achieve high deflection.
11. Separate couplings shall pass a hydrostatic integrity test at the factory in accordance with AWWA C900 Standards.

2.2 WATER SERVICE LINES

A. Water Service Lines 1-inch Diameter and Under.

1. Polyethylene Tubing: Water service lines 1 inch and under shall be high density PE 3408/ PE3608 polyethylene tubing. The polyethylene tubing shall be SIDR 7 high density PE 3408/ PE3608, I.P.S., conforming to ASTM D 2239, AWWA C901, and the Polyethylene PE 3408/ PE3608 specifications. All connections shall be compression type with stainless steel inserts.
2. High performance polyethylene (PE4710) is acceptable and shall meet the requirements listed above.

2.3 PIPE SYSTEM APPURTENANCES

A. Pipe Fittings and Specials:

1. Specials and fittings constructed of ductile iron shall be provided for use with all water line piping and at locations shown on the Drawings.
2. Mechanical joint ductile iron fittings shall conform to the requirements of AWWA C110 or AWWA C153.
3. Flanged fittings shall conform to the requirements of ANSI/AWWA C110/A21-10.
4. Flanges shall be ANSI B16.1 125lb. Class B.
5. Bolts for all flanged fittings shall be stainless steel. Bolts for mechanical joint fittings shall be a corrosion resistant fluorocarbon bolt, or Engineer approved equal.
6. The outside of all ductile iron fittings shall be coated with a bituminous coating.
7. The inside of the ductile iron fittings shall be coated with a standard thickness cement mortar lining.
8. Direct buried ductile iron specials and fittings shall be wrapped with polyethylene encasement material conforming to the requirements of AWWA C105.

B. MJ Transition Sleeves.

1. Transition sleeves shall be of ductile iron, long body, mechanical joint, gasketed, sleeve type, with diameter to properly fit the new watermain pipe to the existing watermain or provide transition between different pipe materials as shown on the Drawings.

    a. All transition couplings shall be ductile iron meeting the requirements of “Pipe Fittings and Specials” of these Specifications.

b. The sleeve shall be wrapped on the exterior with polyethylene wrapping in accordance with AWWA C105.
c. Bolts shall be a corrosion resistant fluorocarbon bolt or Engineer approved equal.

C. Mechanical Joint Restraints.

1. Mechanical joint restraints shall be incorporated in the design of the follower gland. The restraint mechanism shall consist of a plurality of individually actuated gripping surfaces to maximize restraint capability.

a. Glands shall be manufactured of ductile-iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest revision.
b. Twist-off nuts shall be torqued per the manufacturers installation requirements to insure proper actuating of restraining devices.
c. Bolts shall be a corrosion resistant fluorocarbon bolt or Engineer approved equal.
d. The restraining glands shall have a pressure rating equal to that of the pipe on which it is used and shall be:

1) Tyler Union;
2) EBAA Iron, Inc.;
3) Romac Industries, Inc.;
4) Ford Meter Box Company, Inc., or;
5) Engineer approved equal.

D. Foster Adapter: The positive restraint device shall connect the valves and/or fittings at a linear distance not to exceed three (3) inches and without attachment to pipe. The device shall come complete with all accessories, including standard SBR MJ gaskets conforming to the latest revision of AWWA C111/ASTM F-477 and blue fluorocarbon coated bolts and nuts conforming to AWWA C111/A21.11. The bolt-through MJ positive restraining device and the ductile iron spacers shall be supplied with an NSF 61, 7-mil. fusion bonded epoxy conforming to AWWA C116/A21.16-09 as well as the coating, surface preparation and application requirements of ANSI/AWWA C550, interior and exterior. The device shall be used with standard mechanical joint fittings (AWWA C110 or C153) and valves. The device shall be Infact Corporation Foster Adaptor or equal.

2.4 VALVES AND GATES

A. Gate Valves: Gate valves shall be resilient wedge type designed for a minimum water working pressure of not less than 250 psi. Gate tapping valves shall conform to AWWA Standard C515. All gate valves shall be manually operated by 2-inch operating nut. Valves shall have a stationary stem and shall provide a smooth unobstructed waterway and shall be opened by turning counterclockwise. The operating nut shall have an arrow, cast in the metal, indicating the direction of opening. Each valve shall have the maker's monogram or initials, pressure rating and year of manufacture cast on the body. Valves shall be furnished with joints compatible with the pipe to which they are connected.

1. The seal plate shall be fitted with O-ring seals above and below the thrust collar. The modified wedge disc must be fully supported. The disc or wedge shall provide an angular mounting surface for the resilient rubber seat.

2. The valve interior and exterior shall be fully coated with a material approved for potable water in accordance with applicable AWWA Specifications. Each valve shall be tested for zero leakage past the seat at 250 psi and hydrostatically shell tested at 500 psi.
3. Direct buried valves and boxes shall be wrapped with polyethylene encasement conforming to AWWA C105.
4. Bonnet bolts shall be stainless steel.
5. The valves shall be American Flow Control, American AVK or Engineer approved equal.

B. Valve Boxes: Valve boxes for gate valves shall be a multiple piece, Class 35B, cast iron, buffalo type (screw), with a 5-1/4-inch shaft diameter. Valve box castings shall be hot coated inside and outside with a rust resisting coating. The bottom part of the box shall have a bell conforming to the perimeter of the valve. The valve box covers shall be extra deep and fit the valve box snugly to prevent rattles or tipping due to traffic. Covers shall be provided with slots for easy and quick removal and supplied with the word "WATER" cast into the lid.

1. Valve boxes shall be furnished with rubber Valve Box Adaptor II as manufactured by Adaptor, Inc. or Engineer approved equal.

2.5 FIRE HYDRANTS

A. Fire hydrants shall be single dry-barrel non-jacket type conforming to AWWA Standard C502. Each hydrant shall be furnished with two 2-1/2-inch hose nozzles and one pumper connection. The thread patterns shall be compatible with City of Graceville firefighting equipment. The hydrants shall be designed for a working pressure of 250 pounds per square inch and tested at 500 pounds per square inch hydrostatic test pressure. Working parts shall be bronze. Bolts shall be stainless steel.

1. The main valve shall be compression type designed to close and open against main pressure. All operating parts, including the valve seat, shall be removable through the hydrant barrel with the hydrant in place. The operating threads shall be oil or grease lubricated. A safety flange shall be located near the ground line to prevent barrel breakage should the hydrant be struck by vehicles. Hydrants shall be connected to mains with 6-inch diameter pipe. Hydrants shall open counterclockwise and have No. 5 pentagon operating nut. Minimum cover from ground line to the top of the connecting pipe shall be six and a half (6.5) feet. Nozzle caps shall be furnished with No. 5 pentagon nut and be provided with chains attached to hydrants.
2. Hydrants shall be painted with one coat of primer and two finish coats of approved red paint. The buried portion of the hydrant shall be wrapped with polyethylene wrapping in accordance with AWWA C105.
3. Hydrants shall be Waterous Pacer or Engineer approved equal.

2.6 CORPORATION STOPS AND SERVICE SADDLES

A. All waterworks brass shall be no-lead brass complying with USA Public Law 111-380. A marking identifying the “no-lead” brass alloy shall be cast or permanently stamped on each component.

B. Corporation stops shall be constructed of bronze alloy and furnished with tapered inlet thread for connection to service saddle.

1. Corporation stops shall have pack-joint ends suitable for connecting to the type of water service line specified;
2. Corporation stops shall be ball type meeting AWWA C-800 standards.

C. Service saddle bodies shall be stainless steel with tapered thread for connecting to corporation stop.

1. Service saddles shall be provided with stainless steel bolts for connecting to C900 PVC water pipe;
2. Saddles shall be furnished with a Buna-N rubber gasket, cemented in place, and;
3. Approved service saddle manufacturers are as follows:

a. Ford Meter Box Company, Inc.
b. AY McDonald Mfg. Co.
c. Romac Industries, Inc; or.
d. Engineer approved equal.

D. The corporation stops shall be compatible with the water service line material specified.

1. Approved corporation stop manufacturers are as follows:

a. Ford Meter Box Company, Inc.
b. AY McDonald Mfg. Co.; or.
c. Engineer approved equal.

E. The cutting tool used to make service connections shall be a shell type (hole) cutter which will retain the coupon and be designed to accommodate walls as heavy as DR 14.

1. The equipment used shall attach to the corporation stop and permit the cutting tool to be fed through the corporation stop to cut a hole in the pipe, and;
2. The Contractor shall take care to prevent filings from entering the pipe.

2.7 CURB STOPS

A. All waterworks brass shall be no-lead brass complying with USA Public Law 111-380. A marking identifying the “no-lead” brass alloy shall be cast or permanently stamped on each component.

B. Curb stops shall be brass, Minneapolis pattern, and furnished with pack joint ends suitable to make the connection to type of water service line specified.

1. Curb stops shall be ball valve type provided with body sealing and port sealing "O" rings or rubber seats;
2. Curb stops shall meet AWWA C-800 standards, and.
3. Approved curb stop manufacturers are as follows:

a. Ford Meter Box Company, Inc.
b. AY McDonald Mfg. Co.; or.

c. Engineer approved equal.

2.8 CURB BOXES

A. Curb boxes shall be constructed of cast iron conforming to the requirements of ASTM A48 for Class 20 or higher tensile strength.

1. Curb boxes shall be the extension type with tapped lower section for the service stop;
2. Extended length of service box shall be 7 feet;
3. The word "Water" shall be cast in the lid of the service box, and;
4. Curb boxes shall have a minimum inside diameter of 1-1/4 inches.

B. Curb boxes shall include a stationary shut-off rod for each curb box installed.

2.9 SERVICE COUPLING ADAPTERS

A. All waterworks brass shall be no-lead brass complying with USA Public Law 111-380. A marking identifying the “no-lead” brass alloy shall be cast or permanently stamped on each component.

B. Service coupling adapters shall be compression type and constructed of brass with Buna N beveled gasket specifically designed for underground bury. The adaptor(s) shall join the new copper to the existing service.

2.10 POLYETHYLENE ENCASEMENT MATERIAL

A. Polyethylene encasement must meet or exceed the minimum standards established by AWWA C105, Current Edition. Nominal film thickness shall be 8 mil.

B. Polyethylene encasement shall meet minimum size requirements per TABLE 3 of Section 2.15 of DIPRA’s Installation Guide for Ductile Iron Pipe.

C. Polyethylene encasement shall be furnished in tube form for installation on pipe and pipe-shaped appurtenances such as bends, reducers, etc. Sheet film shall be provided and used for encasing all odd-shaped appurtenances such as tees, valves, crosses, etc.

D. Test results from an independent testing agency certifying that the polyethylene encasement meets all criteria established by AWWA C105, current edition, shall be submitted to the Engineer prior to approval of the polyethylene encasement for use.

E. A 2-inch-wide plastic adhesive tape, such as Calpico Vinyl, Polyken 900, or Engineer approved equal, shall be used for sealing seams, cuts, or tears in polyethylene encasement. Duct tape shall not be allowed.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall saw cut and remove surface improvements, excavate and trench, remove water, bed, backfill, and restore surface improvements in accordance with the requirements outlined in the provision for Earthwork for Site Utilities and details shown on the Drawings.

B. At all times when work is not in progress all open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe.

C. If the maximum width of the trench at the top of the pipe specified in Section 31 2300 is exceeded for any reason other than by direction of the Engineer, the Contractor shall, at his own cost, install such concrete encasement or granular embedment material as may be required to satisfactorily support the added backfill load.

3.2 LAYING PIPE

A. The installation of water pipe shall conform to the applicable sections of the "AWWA PVC Pipe, Design and Installation, Manual of Water Supply Practices (AWWA No. M23)", AWWA C605, Uni-Bell Plastic Pipe Association and manufacturer's recommendations.

B. No other pipe or material of any kind shall be placed inside a pipe or fitting. The interior of the pipe shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved methods. The full length of each section of pipe shall rest solidly upon the pipe bed with the recesses to accommodate bells and joints, shaped by hand. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. Pipe shall not be laid in water, or when a trench or weather conditions are unsuitable for work. Water shall be kept from the trench until the joints have been completed in a satisfactory manner.

C. Pipe shall be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it is laid, it shall be repaired or replaced by the Contractor. Any corrective work shall be approved by the Engineer and shall be at the expense of the Contractor without additional cost to the Owner. The Engineer shall be given the opportunity to inspect existing pipe before connection to new pipe is made.

D. If less than four feet of cover is expected, insulation shall be used to protect the pipe from freezing. Cover between four and six feet will be evaluated on a case-by-case situation for insulation requirements. Whenever insulation is required for pipe, individual water services should be evaluated for insulation requirements. The insulation work shall be in accordance with the special provisions, drawings, and manufacturer’s recommendations.

3.3 BLOCKING

A. Fittings at bends in the pipeline shall be firmly wedged against the vertical face of the trench and blocked with concrete as detailed on the Drawings or as directed by the Engineer.

3.4 CUTTING PIPE

A. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Cutting shall be done by means of an approved type of mechanical cutter.

3.5 COUPLINGS AND FITTINGS

A. Pipe, couplings and fittings shall be handled and installed in accordance with the recommendations of the pipe manufacturer.

3.6 JOINTING

A. The type of joint used shall conform to the requirement for the applicable type of pipe. Jointing operations shall be carried out in strict adherence to the manufacturer's recommendations. When joining PVC pipe to ductile iron fittings, the bevel on the PVC shall be made the same as the bevel required for the ductile iron fitting (normally shorter and steeper than factory pipe bevel). When joining to mechanical joint fittings, there shall be no pipe bevel.

3.7 JOINT RESTRAINTS

A. Joint Restraints shall be installed on the pressure pipe fittings and valves at the locations shown on the Drawings.

3.8 FUTURE CONNECTIONS

A. Pipe ends left for future connections shall be valved, plugged, or capped and anchored as shown on the Drawings or as directed by the Engineer. A plastic plug shall be placed at the end of all terminated services. The use of duct tape will not be allowed.

3.9 RAISING OR LOWERING OF WATER LINES

A. Water lines will be raised or lowered by the Contractor in those locations shown on the Plans, or where directed by the Engineer to avoid interference with new utilities. Water line adjustments shall be constructed to provide a minimum of six and a half (6.5) feet of cover over the adjusted water line. Water line adjustments shall not be made until the Utility which owns the water line has authorized such work. The adjusting of water service lines shall be considered incidental.

3.10 WATER AND SEWER MAIN SEPARATION

A. Horizontal Separation: Whenever possible, watermain should be laid at least 10 feet, horizontally, from any existing or proposed sewer. Should local conditions prevent a lateral separation of 10 feet, a watermain may be laid closer than 10 feet to a sewer if:

1. It is laid in a separate trench; or.
2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth;

3. In either case, the elevation of the crown of the sewer is at least 18 inches below the bottom of the water main.
4. Prior approval must be obtained from Engineer and Owner.

B. Vertical Separation: Whenever sewers must cross under watermains, the watermain shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. If the sewer line is less than 18 inches below the watermain, or is above the watermain, either the sewer pipe or watermain shall be fully encased for a distance of ten (10) feet each side of the crossing. The encasement shall consist of PVC encasement pipe closed at the ends with flexible reducing couplings.

C. A reinforced concrete pipe (RCP) storm sewer may cross below a water main with a separation of less than 18 inches or at any height above a water main provided the joints on the RCP within 10 feet of either side of the water main are assembled with:

1. Performed butyl rubber sealant meeting federal specification #SS-S-210A and AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch-thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the water main will not be required when the RCP joints are collared within the 20-foot section.
2. On O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.
3. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.

3.11 CONCRETE CRADLES

A. The pipe shall be supported on concrete cradles where directed by the Engineer. The concrete shall meet a minimum 28-day compressive strength of 2500 psi for Fill Concrete.

3.12 SETTING VALVES, VALVE BOXES AND FIRE HYDRANTS

A. Valves, valve boxes and fire hydrants shall be installed where shown on the Plans and as directed by the Engineer in accordance with AWWA Standard C500 for valves and C600 for fire hydrants except as further specified herein.

1. Valve boxes shall be centered on the valves. Earth fill shall be carefully tamped around each valve box to a distance of four (4) feet horizontally and full depth of the valve box.
2. Fire hydrants shall be set at such elevations that the connecting pipe will not have less cover than the distributing mains.
3. The hydrant shall be set upon a slab of concrete not less than four (4) inches thick and not less than fifteen (15) inches square. The back of the hydrant, opposite the pipe connection, shall be firmly wedged against the vertical face of the trench to prevent the hydrant from blowing off the line.
4. Not less than one (1) cubic yard of broken stone or coarse gravel shall be placed around the base of the hydrant to insure drainage.
5. The backfill around hydrants shall be thoroughly compacted to the grade line in accordance with Section 31 2300 of these Specifications.

6. Hydrants and valves shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened, and the hydrant or valves shall be inspected in opened and closed positions to insure that all parts are in working condition.
7. All underground ductile iron valves, fittings and fire hydrant bodies shall be installed with polyethylene encasement material installed in accordance with AWWA Standard C105.

3.13 ADJUSTMENT OF VALVE BOXES

A. Existing valve boxes which are to remain are to be adjusted by the Contractor. Valve boxes shall be adjusted to be 1/8-inch to 1/4-inch below the top of the finished pavement.

B. All costs due to damaged, cracked, or misaligned valve boxes, due to the carelessness of the Contractor, shall be the responsibility of the Contractor at no cost to the Owner.

3.14 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall be installed per ANSI/AWWA C105/A21.5, Method 'A' in accordance with section 2.15 of DIPRA's Installation Guide For Ductile Iron Pipe.

B. A fabric type of padded sling shall be used when handling polyethylene encased pipe to prevent damage to the polyethylene encasement.

C. All seams in the polyethylene encasement shall be sealed completely with approved 2-inch-wide plastic adhesive tape.

D. Extreme care shall be taken to ensure that all rips or tears in the polyethylene encasement are properly repaired with additional tape and film as described in ANSI/AWWA C105/ A21.5. Care shall be taken when backfilling to avoid damaging the polyethylene encasement.

E. It is the Contractor's sole responsibility to ensure the polyethylene encasement is properly installed in condition to serve its normal service life.

3.15 DISINFECTION

A. Each unit of completed potable water line shall be disinfected with chlorine and tested for bacteriological quality and found to meet the standards prescribed by the Minnesota Department of Health before acceptance for domestic operation.

B. The Contractor shall furnish all materials and perform the disinfecting, flushing, and testing as necessary for meeting the water quality requirements.

1. Method: Disinfection shall be completed in accordance with American Water Works Association Standard C651, current edition Tablet Method for Disinfecting Water mains.

    a. The Tablet Method consists of placing either calcium hypo-chlorite granules or tablets in the water main as it is being installed and filling the main with potable water when installation is completed.
    b. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

c. The Tablet Method shall give an average chlorine dose of 25 mg/1.

1) Placing of Calcium Hypochlorite Granules: During construction, calcium hypochlorite granules shall be placed at the upstream end of each branch main, at the upstream end of the first section of pipe, and at 500-foot intervals. The quantity of granules shall be as shown in the following table:

TABLE OF OUNCES OF CALCIUM HYPOCHLORITE GRANULES TO BE PLACED AT BEGINNING OF MAIN AND AT EACH 500-FOOT INTERVAL	
Pipe Dia. (Inches)	Calcium Hypochlorite Granules (Ounces)
4	1.7
6	3.8
8	6.7
WARNING: The above-mentioned procedure must not be used on solvent-welded plastic or screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.	

2) Placing of Calcium Hypochlorite Tablets: During construction, 5-gram calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenances. The number of 5-gram tablets required for each pipe section shall be 0.0012 D2L rounded to the next highest integer, where D is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. The following table shows the number of 5-gram tablets required for commonly used sizes of pipes:

TABLE OF NUMBER OF 5-GRAM CALCIUM HYPOCHLORITE TABLETS REQUIRED FOR DOSE OF 25 MG/L*					
	Length of Pipe Section				
Pipe Dia. (Inches)	≤13	18	20	30	40
	Number of 5-Gram Hypochlorite Tablets				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
*Based on 3.25 grams available chlorine per tablet.					

a) The tablets shall be attached by an adhesive Permatix* or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length.

3) Water Main Tie-In: Where an existing water main is cut for the installation of any fittings, the pipe and fittings proposed to be installed shall be disinfected prior to installation as follows:

a) The interior of the pipe and fittings shall be cleaned of all dirt and foreign material.
b) The interior of the pipe and fittings shall be thoroughly swabbed or sprayed with a 1 percent minimum hypochlorite solution.

4) Filling and Contact: When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 foot per second. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41 degrees F, the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.
5) Final Flushing:

a) Clearing the Main of Heavily Chlorinated Water: After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.
b) Disposing of Heavily Chlorinated Water: Water used for disinfection must not reach a stream, river, or other waterway of the state if chlorine is detected in the water. Contact SDDENR Surface Water Quality Program at (605) 773-3351 for more information.

C. Bacteriological Tests: After final flushing and before the water main is placed in service, a minimum of two samples shall be collected from each unit at the end of the line in addition to two samples per 800 feet of completed potable line which all associated costs are incidental to the project. A unit of completed potable line is defined as each segment the Contractor elects to test individually prior to connection to the potable water system. The samples shall be tested for bacteriological quality in accordance with “Standard Methods for the Examination of Water and Wastewater”, meet the standards prescribed by the Minnesota Department of Health, and shall show the absence of coliform organisms. The Contractor shall perform additional BacT tests as directed by the Engineer or Owner.

D. Redisinfection: If the initial disinfection fails to produce satisfactory bacteriological samples, the main may be reflushed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the Continuous Feed Method or Slug Method in accordance with AWWA, C651, current edition.

E. Alternate Methods: The Contractor may, at his option, use either the Continuous Feed or Slug Method in lieu of the specified Tablet Method. The procedures for the alternate methods are described in AWWA C651, current edition.

1. It should be noted that the specified Tablet Method shall be used only if the pipes and appurtenances are kept clean and dry during construction.

3.16 HYDROSTATIC TESTING FOR WATER LINES

A. General: It is the intent of this Specification that all joints in piping be watertight and that all joints which are found either by observation or any specified test to leak shall be made watertight by the Contractor. The water main shall be tested in accordance with AWWA C605 or as specified herein.

B. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to the hydrostatic pressure listed below at the point of testing.

1. Pressure gauge shall be a standard pressure gauge that registers 0-200 psi with 1 psi increments. Dial size shall be 4-1/2-inch diameter.
2. Test Pressure Restrictions: Test pressures shall be:

    a. Not be less than 120 psi.
    b. Not exceed pipe or thrust restraint design pressures.
    c. Be of at least 2-hour duration with no loss in pressure.
    d. Subjected to a leakage test if pressure loss is observed during the testing period.
    e. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
    f. Not exceed the rated pressure of the valves if resilient-seated butterfly valves are used.

3. Pressurization: Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.
4. Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such points so that air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be left in-place.
5. Examination: All exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Engineer.

C. Leakage Test:

1. General: A leakage test shall be conducted concurrently with the pressure test.

    a. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2. Field hydrostatic testing shall be conducted for 2 hours after the pipeline section is brought up to the specified test pressure +/- 5 psi. Contractor shall add “make-up” water as needed to maintain the specified test pressure +/- 5 psi. The test shall be extended if the pressure exceeds +/- 5 psi of the specified test pressure for a period of time equal to

the time out of range. At the end of the 2 hour test, “make up” water shall be added to bring the pressure back to the initial test pressure at start of test. Calibrated water meters, graduated containers, or graduated tanks are approved as a means to determine the quantity of water that must be added to the test section to maintain the required pressure of the pressure test after the test section has been pressurized. After the field hydrostatic testing of the section of pipeline has been accepted, the Contractor shall relieve the pressure on the pipeline and leave the pipeline full of water.

3. Allowable Leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{ND(P)^{1/2}}{7{,}400}$$

Where

L = The allowable leakage, in gallons per hour.
N = Number of joints
D = The nominal pipe diameter, in inches.
P = The average test pressure during the leakage test, in psi (gage).

   a. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size shall be allowed.
   b. When hydrants are in the test section, the test shall be made against the closed hydrant.

4. Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe discloses leakage greater than that specified in "Allowable Leakage", above, the Contractor shall, at his expense, locate and repair the defective material and retest until the leakage is within the specified allowance.

   a. All visible leaks are to be repaired regardless of the amount of leakage.

3.17 MAINTAINING WATER SERVICE

A. During the replacement of existing watermains and installation of new watermains the water service shall be maintained during construction, except for brief shutdowns to connect into existing watermains. The shutdowns for "cut-in" shall be during low demand periods and adequate notice shall be given to the affected water consumers. During the replacement of an existing watermain, the Contractor shall supply water to the consumers by a temporary above ground piping system. The necessary pipe, fittings, valves etc. required for the temporary water services shall be considered incidental to the project.

3.18 ABANDONMENT & REMOVAL OF EXISTING WATERMAIN

A. Watermain, fire hydrants, water services, valves, etc. shall be abandoned or removed as indicated on the plans. Contractor shall be responsible for proper disposal of all un-salvaged watermains, valves, fittings, fire hydrants, etc.

3.19 CLEAN-UP

A. Upon completion of the work, the Contractor shall remove all surplus construction materials and debris resulting from the work, and all areas of work shall be left in an orderly manner.

END OF SECTION

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SECTION 333000 - SANITARY SEWERAGE 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. Gravity Sewer Pipe.
2. PVC Fittings and Specials.
3. PVC Clean-outs.
4. Sanitary Sewer Manholes.
5. Manhole appurtenances.

B. Related Sections include the following:

1. Section 311000 “Site Clearing” for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above-and below-grade improvements and utilities.
2. Section 312300 “Trenching Excavation and Backfilling” for soil materials, excavating, and backfilling.
3. Section 312000 “Earth Moving” for soil materials, excavating, and site grading.

1.3 SEWAGE LEAKS OR SPILLS

A. The Contractor shall notify MPCA and be responsible for all clean-up costs for sewage leaks and spills. Spill reporting requirements are to the following numbers.

1. Environmental Emergencies 800-422-0798.
2. Sewage spills shall be reported to MPCA regarding municipal waste spills at 1-800-422-0798.

PART 2 PRODUCTS

2.1 GRAVITY SEWER PIPE

A. General: Pipe furnished for installation on this project shall be of the size and type shown on the Drawings. The pipe shall be manufactured from one of the materials designated for the specified line and application as described in the following subsections.

B. Polyvinyl Chloride (PVC) Sewer Pipe (SDR35/26):

1. General Requirements:

a. Polyvinyl Chloride sewer pipe in sizes 4”-15" shall be type PSM conforming with the "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings" (ASTM D3034).
b. Wall thickness of pipe and pipe stiffness (F/ΔY) at 5% deflection shall meet the minimum requirements for PS 46 psi for SDR35 or PS 115 psi for SDR 26 pipe as follows:

    1) 4” and 6” pipe size shall be SDR 26.
    2) 8” to 15” pipe sizes shall be SDR 26 for installation depths greater than 14 feet.
    3) 8” to 15” pipe sizes shall be SDR 35 for installation depths less than 14 feet.

c. Standard lengths shall be per manufacturer’s standard length.
d. Joints shall be elastomeric gasket type.
e. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring which meets the requirements of "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe", (ASTM F477).
f. Solvent cement joints will not be allowed.

2.2 POLYVINYL CHLORIDE (PVC) SPECIALS AND FITTINGS:

A. General: PVC fittings and specials furnished for installation on this project shall be of the size and type shown on the Drawings.

1. General Requirements:

    a. All tees, wyes, service line bends, plugs, etc. shall be elastomeric gasket type.
    b. All PVC fittings and specials shall be SDR 26.
    c. All gasketed specials and fittings shall be installed in accordance with the manufacturer’s recommendations.
    d. It will be the Contractor's responsibility to keep accurate records of the location of each wye and stub out and give to the Engineer or Resident Project Representative each day before backfilling, so that its accuracy can be checked. All wye locations shall be recorded on the Contractor's Construction Plans of Record Drawings, and all Drawings shall be turned in to the Engineer or Resident Project Representative for review and approval.

2.3 REPAIR COUPLINGS:

A. Connections to existing sewer pipes shall be made with a repair coupling. A gasketed PVC coupling shall be used when connecting to existing PVC pipe with the same O.D.

B. Couplings shall also be used to connect pipes of different materials. Couplings shall utilize a gasket, clamps, shear ring and coupling and be manufactured to conform to the performance requirements of ASTM C1173, latest edition. Clamps and bands shall be 316 stainless steel and available in two nut and bolt take-up points per band in 6-inch and larger sizes. Couplings shall be Fernco Strong Back RC series repair couplings or Engineer approved equal.

2.4 ENCASEMENT PIPE (PVC)

A. Encasement pipe for sewer lines that cross over or within 18" below water lines shall be Class 160 Polyvinyl Chloride pipe.

1. All pipe must meet the requirements as set forth in "Polyvinyl Chloride (PVC) Pressure-Rate Pipe (SDR Series)" ASTM D2241 with a standard dimension ratio (SDR) of 26.
2. All PVC pipe shall be gasket jointed for meeting the requirements of "Standard Specification for Elastomeric Seals for Joining Plastic Pipe" with ASTM D3139, "Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals".
3. Pipe materials shall conform to "Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds (ASTM D1784).
4. The encasement pipe shall extend no less than ten (10) feet on each side of the waterline which is being crossed. Pipe within the encasement pipe shall be supported by manufactured chock units.
5. Flexible reducing couplings for use on the Class 160 PVC encasement pipe shall be as manufactured by FERNCO or Engineer approved equal.

2.5 MANUFACTURED CHOCKS

A. Pipe within the encasement pipe shall be supported by manufactured chock units.

1. Metal components of manufactured chock units shall be type 304 stainless steel. The liner shall be heavy duty PVC or neoprene rubber. The chock runner shall be UHMW polyethylene or Engineer approved equal with high abrasion resistance and low coefficient of friction.
2. The chock runner shall be UHMW polyethylene or Engineer approved equal with high abrasion resistance and low coefficient of friction.
3. The pipe support method used shall provide support for the pipe at the center and each end of each length of pipe.
4. The manufactured chock units shall be similar and equal to the models manufactured by Powerseal Corporation, Raci, or Engineer approved equal. The materials used for pipe support shall be approved by the Engineer.

2.6 MANHOLES

A. Manholes shall be designed to withstand HS-20 AASHTO live loading. Precast structures shall be designed and reinforced by the manufacturer to support all superimposed dead loads and the design loads indicated in the Drawings.

B. Manholes shall be constructed of precast concrete sections with cast iron frames and covers and in accordance with the Drawings.

1. Manholes shall be constructed with an integral base section, rubber gasketed tongue and groove joints and with the least number of section joints possible. Precast reinforced concrete manhole sections shall conform to ASTM C478.
2. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section.

3. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit.
4. Changes in size and grade of the channels shall be made gradually and evenly.
5. The invert channels may be formed directly in the concrete of the manhole base, may be half pipe laid in concrete, or may be constructed by laying a full section of sewer pipe through the manhole and cutting out the top half after the surrounding concrete has hardened.
6. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than one (1) inch per foot and not more than two (2) inches per foot.
7. The elevation drop through the manhole from inlet to outlet shall be as indicated on the drawing.
8. No steps will be allowed in manholes. All sections delivered to site with steps will be rejected.

C. It is required that manholes be completely watertight. Therefore, flexible manhole sleeves approved by the Engineer shall be used at pipe unions with manhole bases and walls. The sleeve shall be properly sized for the application, constructed of stainless components and polyisoprene rubber. The Positive Seal Gasket System shall be PSX: Direct Drive as manufactured by Press-Seal Gasket Corporation, or equal.

D. All joints and lift holes shall be completely filled with mortar and shall be smooth and free from surplus mortar on the inside of the manhole. Joints between precast manhole sections shall be sealed by use of Gasketed Sections in accordance with ASTM Specification C443. In addition, a strip of 1/2-inch joint sealant shall be installed between all tongue and groove joints.

1. Lifting holes cast into manholes and structures shall not penetrate through the wall. At least 1-inch of wall thickness shall remain at lifting holes.
2. The exterior joints between precast manhole sections shall be installed with an exterior joint collar. The joint collar shall be Cretex Wrap Exterior Joint Sealer as manufactured by Cretex Specialty Products or an approved equal. The collar shall be 9-inches wide with two steel straps with ratchets and have an outer layer of polyethylene with an under layer of rubberized mastic that is reinforced with a woven polypropylene fabric.
3. The bituminous mastic shall be "Kent Seal", EZ STIK, or Engineer approved equal. The sealant shall be sized such that the joint is filled to 50% (min.) of its annular volume when fully assembled, and the sealant shall have the ends kneaded together at the overlap. Primer and/or adhesive as recommended by the sealant supplier shall be employed for adverse, critical, or other applications.

E. There shall be at least two (2) 2-inch or one (1) 4-inch adjusting ring(s) and a maximum of 12 inches precast or High-Density Polyethylene (HDPE) adjusting rings used on every manhole. Adjustments of 8-inches or greater shall utilize 6-inch or 4-inch-thick rings. The manhole frame shall be set to the elevation set by the Engineer.

1. Provide a watertight seal between adjusting rings, between adjusting rings and manhole frame and between manhole and adjusting rings.
2. HDPE rings shall conform to ASTM D4976 as manufactured by Ladtech, Inc., IPEX, Inc., or Engineer approved equal.
3. Watertight sealant for HDPE adjusting rings shall be Dow 999-A building caulking and glazing sealant or Engineer approved equal.
4. An external chimney seal shall be installed on all new manholes.

2.7 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be made of cast iron conforming to ASTM A48, Class 35B designed for H20 loading conditions.

1. Standard castings differing in non-essential details and approved by the Engineer will be acceptable.
2. The manhole frame and cover for paved surfaces shall be heavy duty Neenah R-1733 or East Jordan 1205 with self-sealing solid lid.
3. The manhole covers and frames shall be set so the top of the cover will be flush with, above or below the finished grade as shown in the Drawings or directed by the Engineer. The standard height of the frame shall be 7", however differing heights may be needed and should be supplied.
4. Manhole covers and frames shall have machined bearing surfaces.
5. Covers shall be solid with no vent holes and shall have casted letter indicating "SANITARY SEWER.".
6. An improved concealed pick hole similar to the East Jordan EPIC Pick Bar or Engineer approved equal shall be provided.
7. All covers shall be supplied from manufacturer with pre-installed, glue-in, self-sealing type "T" gasket. The gasket shall be installed in a machined groove and be continuous around the perimeter. The gasket material shall be oil resistant Nitrile (60 DURO) glued in the groove and have a maximum swell of 90-percent when tested in accordance with ASTM D471 using ASTM No. 3 oil.

2.8 CHIMNEY SEAL

A. Chimney seal shall be external manhole chimney seal as listed on the Project Drawings. Chimney seals shall be manufactured by Cretex Specialty Products, Sealing Systems, Inc., CCI Piping Systems, or Engineer approved equal. Extensions, if required, shall also be the same manufacturer as the chimney seal. The chimney seal shall extend from the manhole frame to the top of the manhole cone.

2.9 INSULATION

A. Pipe insulation shall be an extruded polystyrene board meeting the requirements of ASTM C578, Type IV. Expanded polystyrene board is not an approved product.

1. Minimum board thickness shall be 2".
2. Minimum R-Value shall be 10 in accordance with ASTM C518.
3. Minimum compressive strength shall be 25 psi in accordance with ASTM D1621.
4. Maximum water adsorption shall be 0.3% by volume in accordance with ASTM C272.
5. Maximum water vapor permeance shall be 1.1 perm in accordance with ASTM E96.

B. Pipe insulation shall be as follows or Engineer approved equal:

1. FOAMULAR® insulating sheathing by Owens Corning Company or,
2. STYROFOAM™ Brand Scoreboard by Dow Chemical Company.

C. Pipe insulation shall be STYROFOAM™ Square Edge by the Dow Chemical Company, STYROFOAM™ Brand Scoreboard by the Dow Chemical Company, or an Engineered approved equal.

2.10 MANHOLE BOOTS

A. Manhole boots shall be used for pipe penetrations in both pre-cast and manholes as shown on the plans. Provide “boot” assembly, properly sized for the application, constructed of stainless components and polyisoprene rubber. The Positive Seal Gasket System shall be PSX or PSX: Direct Drive as manufactured by Press-Seal Gasket Corporation, or equal.

2.11 SANITARY SEWER CLEANOUT

A. Gravity sewer line cleanouts shall be constructed in accordance with the details shown on the Drawings and at the locations shown on the Drawings or as directed by the Engineer and in accordance with applicable sections of the State Plumbing Code.

B. Gravity line cleanouts shall be of the same diameter and material as the pipeline.

C. Cast iron frames and covers equivalent to Neenah R1976, Deeter 1820 or Engineer approved equal shall be provided for each gravity cleanout along collection lines. The cleanout pipes shall be fitted with plastic cleanout adapters with raised threaded removable plugs as shown on the Drawings. Caps will not be acceptable. Contractor shall provide one (1) 12" long tee wrench suitable for removing the threaded plugs.

PART 3 EXECUTION

3.1 GENERAL

A. The contractor shall saw cut and remove surface improvements, excavate and trench, remove water, bed, backfill, and restore surface improvements in accordance with the requirements outlined in Section 31 2000 of these Specifications and details shown on the Drawings.

B. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe.

C. If the maximum width of the trench at the top of the pipe specified in Section 31 2300 is exceeded for any reason other than by direction of the Engineer, the Contractor shall, at his own cost, install such concrete encasement or granular embedment material as may be required to satisfactorily support the added backfill load.

3.2 LAYING PIPE

A. The installation of pipe shall conform to the applicable sections of the "Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe" (ASTM D2321), Uni-Bell PVC Pipe Association Specification UNI-B-3, "Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe), and manufacturer's recommendations except as otherwise directed by the Engineer or noted herein.

B. Pipe shall be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it is laid, it shall be repaired or replaced by the Contractor. Any corrective work shall be approved by the Engineer and shall be at the expense of the Contractor without additional cost to the Owner.

C. The Engineer shall be given the opportunity to inspect existing pipe before connection to new pipe is made. Pipe shall be laid upgrade. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. As the work progresses, the interior of the pipe shall be cleaned of all dirt and superfluous materials of every description.

3.3 CUTTING PIPE

A. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Cutting shall be done by means of an approved type of mechanical cutter. Pipe shall be beveled when appropriate and free of burrs that may damage the gasket.

3.4 COUPLINGS AND FITTINGS

A. Pipe, couplings and fittings shall be handled and installed in accordance with the recommendations of the pipe manufacturer.

3.5 JOINTING

A. The type of joint used shall conform to the requirement for the applicable type of pipe. Jointing operations shall be carried out in strict adherence to the manufacturer's recommendations.

3.6 WATER AND SEWER MAIN SEPARATION

A. Horizontal Separation: Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed watermain. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a watermain if:

1. It is laid in a separate trench; or.
2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.
3. In either case, the elevation of the crown of the sewer is at least 18 inches below the bottom of the water main.
4. Prior approval must be obtained from Engineer and Owner.

B. Vertical Separation: Whenever sewers must cross under watermains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. If the sewer line is less than 18 inches below the watermain, or is above the watermain, either the sewer pipe or watermain shall be fully encased for a distance of ten (10) feet each side of the crossing. The encasement shall consist of PVC encasement pipe closed at the ends with flexible reducing couplings. Concrete shall be used around all fittings which need to be encased, otherwise, the PVC encasements shall be used. The minimum thickness of the concrete shall be six (6) inches.

3.7 RAISING OR LOWERING OF WATER LINES

A. Water lines will be raised or lowered by the Contractor in those locations shown on the Plans, or where directed by the Engineer to avoid interference with new utilities. Water Line adjustments shall be constructed to provide a minimum of six (6.5) feet of cover over the adjusted water line. Water line adjustments shall not be made until the Utility which owns the water line has authorized such work. The adjusting of water service lines shall be considered incidental.

3.8 CONCRETE CRADLES

A. The pipe shall be supported on concrete cradles where directed by the Engineer. The concrete shall meet a minimum 28-day compressive strength of 2500 psi for Fill Concrete.

3.9 CONNECTIONS

A. The Contractor shall make all connections to existing piping and structures from which wastewater is to be received or discharged.

3.10 ADJUSTMENT OF MANHOLES AND COVERS

A. Existing manholes which are to remain are to be adjusted by the Contractor. Under this item of work, the approximate quantity of adjustments are as shown in the Bid. The Engineer may increase or decrease the number of manholes to be adjusted. In performing this work, the Contractor shall, if necessary, add or remove concrete rings or upper course of brick and buildup the manhole rims to an elevation flush with the top of the finished pavement.

B. All costs due to damaged, cracked or misaligned manholes and covers, due to the carelessness of the Contractor, shall be the responsibility of the Contractor.

3.11 MANHOLES

A. Manholes shall be installed at the locations shown and in conformance with the details shown on the Drawings or as directed by the Engineer.

3.12 CHIMNEY SEAL

A. Chimney seal shall be installed in accordance with manufacturer’s recommendations. Manhole frame, adjusting rings, and cone shall be cleaned and prepped prior to installation of chimney seal in accordance with manufacturer recommendations. An expansion tool shall be used to ensure a proper seal is achieved. The chimney seal may require multiple removals and reinsertion to obtain a proper seal.

3.13 TESTING

A. Gravity Sewers.

1. General: Prior to testing, all sewer lines shall be cleaned and inspected for major defects. Pre-cleaning by appropriately sized sewer cleaning ball or high velocity jet or other

method may be necessary. All sewer lines shall be inspected visually to verify accuracy of alignment and freedom from debris and obstructions. The full diameter of the pipe for straight alignments shall be visible when viewed between consecutive manholes.

a. Tests for water tightness shall be made in the presence of the Engineer. Plugs, caps and branch connections must be secured against blow-off during leakage test.
b. The Contractor shall furnish all the necessary equipment and be responsible for conducting all tests.
c. If a section of sewer fails to meet the testing requirements, the Contractor shall determine, at his own expense, the source or sources of leakage, and he shall repair or replace all defective materials and/or workmanship to the satisfaction of the Engineer. The extent and type of repair which may be allowed, as well as results, shall be subject to the approval of the Engineer. The completed pipe installation shall then be retested and required to meet the requirements of the referenced test. Acceptance tests for leakage shall be satisfactory before the sewer will be accepted by the Owner. Contractor shall pay for all failed tests.

2. Manhole Testing: During the construction of the manholes, the Contractor shall, in accordance with good practice, ensure that no earth, sand, rocks or other foreign material exists on the joint surfaces during assembly of the sections.

a. The Engineer shall visually check each manhole, both exterior and interior, for flaws, cracks, holes, or other inadequacies which might affect operation or watertight integrity of the manhole. Should any inadequacies be found, the Contractor, at his expense, shall make any repairs deemed necessary by the Engineer.
b. Prior to testing, all lines leading into or out of the manhole shall be tightly plugged. The manhole shall be filled with water to its maximum level. The water shall be allowed to stand for two hours to allow for normal absorption into the manhole material. At the end of the two-hour stabilization period, if the water level in the manhole has dropped below the top ring joint, additional water will be added to bring the level above the joint as before. Any visible external leakage noted within the one-hour test period shall constitute failure and the Contractor shall, at his own expense, repair the manhole and retest until satisfactory tightness is obtained.

1) Manhole Vacuum Testing: The manhole vacuum test shall be performed in accordance with ASTM C1244. The following procedure is summarized from ASTM C1244 and shall be followed in conjunction with ASTM C1244 unless modified by the Engineer. The vacuum test shall include testing the top of the manhole, excluding the adjusting rings and manhole frame and cover. Testing will be allowed after backfilling has occurred or as specified in the Special Provisions. Manhole vacuum tester assembly and vacuum pumps shall be as manufactured by Cherne Industries, Inc. or approved equal. Repair of leaks may require the removal and replacement of manhole sections. The use of grout to repair leaks will not be allowed.

a) All lift holes shall be plugged.
b) All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

c) The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
d) A vacuum of 10-inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9-inches of mercury.
e) The manhole shall pass if the time for the vacuum reading to drop from 10-inches of mercury to 9-inches of mercury meets or exceeds the values indicated in Table (Manhole Vacuum Test).
f) If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

Table (Manhole Vacuum Test) Minimum Test Times for Various Manhole Diameters in Seconds			
Depth (ft)	48" Dia.	60" Dia.	72" Dia.
	Time, in seconds		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73

3. Deflection Testing: Deflection tests shall be performed by the Contractor on all PVC sewers. Deflection tests shall be conducted after the final backfill has been in place at least 30 days. Deflection tests shall be made using a deflection gauge (mandrel) device or other approved method. The diameter of the deflection gauge device shall be 95% of the undeflected inside diameter of the flexible pipe. The Contractor shall be required to install the pipe in such a manner so that the diametric deflection of the pipe shall not exceed 5 percent. All pipe exceeding the 5 percent deflection within the one-year warranty period shall be re-laid or replaced by the Contractor at no additional cost to the Owner. All costs for the deflection test shall be borne by the Contractor at no expense to the Owner.
4. Television Inspection: If deficiencies are found in either the air test or deflection test, the Contractor shall perform an inspection of the completed sewer line through the use of a television camera. Inspection shall be completed in accordance with NASSCO PACP inspection requirements and the Engineer shall be provided with completed video and written documentation. If defective workmanship of material or construction is noted, the deficiency shall be corrected by the Contractor at no expense to the Owner. The Contractor shall perform additional television inspections, provide the Owner with a written report, and video documentation that the repairs were made properly and in accordance with the Specifications.

    a. Television inspection shall be performed only when the Resident Project Representative (RPR) is present.

b. The Contractor shall be required to repair all areas of infiltration and other deficiencies. The Contractor shall be responsible for all related costs, including concrete or asphalt resurfacing if the street has been surfaced.

3.14 CLEAN-UP

A. The Contractor shall maintain the work area in a clean and presentable condition during his work operation and shall clear the area of surplus construction materials, debris and rubbish resulting from his operations. The site shall be left in a satisfactory clean and neat appearance.

B. The Contractor shall be responsible for all work necessary to make the sewer acceptable for usage including removal of all mud, silt, rocks or blockages that might hinder the flow and made said sewer unacceptable for acceptance and usage. Also included is all work necessary in the manholes and all cleanup work required prior to acceptance.

3.15 ABANDONMENT & REMOVAL OF EXISTING SANITARY SEWER

A. Sanitary sewer pipe, manholes, sewer services, etc. shall be abandoned or removed as indicated on the plans. All materials removed shall be disposed of by the Contractor at a site provided by the Contractor. Existing sanitary sewer pipe to be abandoned shall be plugged at the ends with concrete. Existing manholes to be abandoned shall have minimum 2.5 feet removed from the top, existing sewer main into manhole plugged with concrete and manhole filled with gravel material. All castings shall remain the property of the Owner and shall be stockpiled by the Contractor at a site provided by the Owner.

END OF SECTION

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SECTION 334100 - STORM UTILITY 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 DESCRIPTION

A. This Section of the Specification includes the following:

1. Storm Sewer Pipe.
2. Storm Sewer Fittings.
3. Junction Boxes.
4. Storm Sewer Manholes.
5. Area Inlets.
6. Drop Inlets.

B. Related Sections include the following;

1. Division 31; Section “Site Clearing” for temporary erosion and sediment control measures, site stripping, stripping and stock piling topsoil, and removal of above - and below - grade improvements and utilities.
2. Division 31; Section “Trenching Excavation and Backfilling” for soil materials, excavating, and backfilling.
3. Division 31; Section “Earth Moving” for soil materials, excavating, and site grading.

PART 2 PRODUCTS

2.1 STORM SEWER PIPE

A. General: Pipe furnished for installation on this project shall be of the size and type shown on the Drawings. The pipe shall be manufactured from one of the materials designated for the specified line and application as described in the following subsections.

B. Dual-Wall Corrugated High Density Polyethylene Pipe: The pipe and fittings shall be manufactured from high-density polyethylene (HDPE) compounds. Pipe supplied shall be smooth interior and annular exterior corrugated HDPE pipe meeting the requirements of AASHTO M294, Type S. Clean reworked HDPE materials from the manufacturer’s own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all requirements of these special provisions, AASHTO M294 and Section 12 of the AASHTO LRFD Bridge Design Specifications. Connections shall be made with bell and spigot joints. Bell and spigot joints shall use a gasket if necessary to make the joint silt-tight per AASHTO M252 or M294. Gaskets shall meet or exceed the requirements of ASTM D1056 Grade 2A2 or ASTM F477.

C. Polyvinyl Chloride (PVC) Storm Sewer Pipe (SDR26):

1. Allowed for pipe 18-inches in diameter or less.
2. General Requirements:

a. Polyvinyl Chloride sewer pipe in sizes 4”-15" shall be type PSM conforming with the "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings" (ASTM D3034).
b. Polyvinyl Chloride sewer pipe in sizes 18”-48" shall be type PSM conforming with the "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings" (ASTM F679).
c. Wall thickness of pipe and pipe stiffness (F/ΔY) at 5% deflection shall meet the minimum requirements for PS 115 psi for SDR26 pipe.
d. Standard lengths shall be per manufacturer’s standard length.
e. Joints shall be elastomeric gasket type.
f. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring which meets the requirements of "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe", (ASTM F477).
g. Solvent cement joints will not be allowed.

2.2 STORM SEWER MANHOLES

A. Storm sewer manholes shall be cast in place or constructed of precast concrete sections with cast iron frames and covers in accordance with the Drawings. The invert channels shall be smooth conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base. The floor of the manhole shall be smooth and shall slope toward the low invert not less than one (1) inch per foot and not more than two (2) inches per foot.

B. All concrete and concrete grout used in construction shall meet the requirements in MnDOT Standard Specification Section 2506. Precast reinforced concrete manhole sections shall conform to ASTM Standard Specifications.

C. All joints and lift holes shall be completely filled with mortar and shall be smooth and free from surplus mortar on the inside of the manhole. Joints between precast manhole sections shall be sealed with packaged bitumastic or butyl rubber rope material between the tongue and groove.

2.3 JUNCTION BOX

A. Junction boxes shall be cast in place or constructed of precast concrete sections and constructed in accordance with the Drawings. All concrete and concrete grout used in construction shall meet the requirements in MnDOT Standard Specification Section 2506.

2.4 AREA INLETS

A. Area Inlets shall be cast in place or constructed of precast concrete sections and constructed in accordance with the Drawings. All concrete and concrete grout used in construction shall meet the requirements in MnDOT Standard Specification Section 2506.

B. PVC Area Inlets.

1. Description: PVC body with integral water tight pipe connections.

a. Nyloplast 18" 24" or 30" Drain Basin (2818AG), (2824 AG), or (2830 AG) or equal.

1) Size: 18", 24", or 30" see Drawings.
2) Grate: Nyloplast ductile iron frame and grate or equal.

a) Standard H20 rated, use where indicated.

b. Structure to be shipped to site at full height. Contractor to field cut structure to actual height.
c. Yard Drains less than 18" diameter to have a Nyloplast ductile iron drop in grate or equal.

C. PVC drop inlets shall be manufactured from pipe meeting ASTM D3034 and ASTM F679. The frame, grate and hood for each structure are considered an integral part of the drop inlet and shall be furnished by the same manufacturer. Base, riser, and top sections shall be manufactured as one integral part and shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, ASTM F679, ASTM F794, ASTM F949, and ASTM F1336. The inlet shall have a thermally molded and bonded integral bell coupling(s). Joint integrity shall match that specified in section 2.1.B. Bells shall allow for a minimum of 1.5 degree axial joint misalignment while maintaining joint integrity.

2.5 DROP INLETS

A. Drop inlets shall be cast in place or constructed of precast concrete sections and constructed in accordance with the Drawings. Drop inlets shall be provided with weep holes as indicated on the drawings. All concrete and concrete grout used in construction shall meet the requirements in MnDOT Specification Section 2506.

2.6 SPECIAL FITTINGS

A. Concrete pipe bends, increasers, end caps, flared ends, and miscellaneous fittings shall be fabricated in accordance with the details or descriptions shown on the Drawings.

B. HDPE or PVC pipe bends, increasers, tees, wyes, and other fittings shall be fabricated in accordance with the details included in this specification. Joint performance shall match that of the pipe connections. Fittings shall conform to AASHTO Standard Specifications.

C. Drain tile trash guards shall be Agri-Guard Yellow Bar Guard or equivalent.

2.7 JUNCTION BOX, MANHOLE, DROP INLET, AREA INLET CASTINGS

A. Frames and covers for junction box, manhole, drop inlet, area inlet shall be made of cast iron conforming to ASTM A48 Class 35B. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Cast iron frames, grates and covers shall conform to the Drawing in all essentials of design. Standard castings differing in non-essential details and approved by the Engineer will be acceptable. Before leaving the foundry all castings shall be thoroughly cleaned by sandblasting. Junction box, Manhole, Area Inlets covers and frames shall have machined bearing surfaces.

2.8 FLARED END

A. General: Flared ends furnished for installation on this project shall be of the size and type shown on the Drawings. The flared end shall be manufactured from one of the materials designated for the specified line and application as described in the following subsections.

2.9 FILL CONCRETE

A. Concrete used to provide drainage to the outlet on the junction box, manhole floor shall attain a minimum ultimate 28-day compressive strength of not less than 2500 psi when tested in accordance with the "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall saw cut and remove surface improvements, excavate and trench, remove water, bed, backfill, and restore surface improvements in accordance with the requirements outlined in Section 31 2000 of these Specifications and details shown on the Drawings.

B. At all times when work is not in progress all open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe.

C. If the maximum width of the trench at the top of the pipe specified in Section 31 2000 is exceeded for any reason other than by direction of the Engineer, the Contractor shall, at his own cost, install such concrete encasement or granular embedment material as may be required to satisfactorily support the added backfill load.

3.2 LAYING PIPE

A. Pipe shall be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it is laid, it shall be repaired or replaced by the Contractor. Any corrective work shall be approved by the Engineer and shall be at the expense of the Contractor without additional cost to the Owner.

B. The Engineer shall be given the opportunity to inspect existing pipe before connection to new pipe is made. Pipe shall be laid upgrade. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. As the work

progresses, the interior of the pipe shall be cleaned of all dirt and superfluous materials of every description.

C. Installation of HDPE pipe shall conform to the requirements of ASTM 2321.

3.3 JOINTING

A. The type of joint used shall conform to the requirements of the applicable type of pipe. Jointing operations shall be carried out in strict adherence to the manufacturer's recommendations.

3.4 CONCRETE CRADLES

A. The pipe shall be supported on concrete cradles where directed by the Engineer. The concrete shall meet as a minimum the requirements for Fill Concrete.

3.5 CONNECTIONS

A. The Contractor shall make all connections to existing piping and structures from which storm water is to be received or discharged.

3.6 JUNCTION BOXES, MANHOLE, AREA INLETS

A. Concrete junction boxes, manholes, area inlets shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans. Reinforcement shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is poured if the junction box, manhole, area inlet is to be cast in place.

B. PVC Area inlets shall be conforming to the dimensions and form indicated on the plans. Installation shall be per manufacturer’s recommendations.

3.7 DROP INLETS

A. Concrete drop inlets shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans. Reinforcement shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is poured.

B. All invert channels shall be constructed and shaped accurately so as to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped downward toward the outlet.

C. PVC drop inlets shall be installed per manufacturer’s recommendations.

3.8 SPECIAL FITTINGS

A. Bends, increasers, end caps, flared ends shall be installed as described in “Laying Pipe” described earlier in these specifications.

3.9 ABANDONMENT & REMOVAL OF EXISTING STORM SEWER

A. Storm sewer pipe, manholes, drop inlets, junction boxes, area inlets etc. shall be abandoned or removed as indicated on the plans. All materials removed shall be disposed of by the Contractor at a site provided by the Contractor.

3.10 TESTING

A. Deflection Testing: Deflection tests shall be performed by the Contractor on all PVC storm sewers. Deflection tests shall be conducted after the final backfill has been in place at least 30 days. Deflection tests shall be made using a deflection gauge (mandrel) device or other approved method. The diameter of the deflection gauge device shall be 95% of the undeflected inside diameter of the flexible pipe. The Contractor shall be required to install the pipe in such a manner so that the diametric deflection of the pipe shall not exceed 5 percent. All pipe exceeding the 5 percent deflection within the warranty period shall be relaid or replaced by the Contractor at no additional cost to the Owner.

B. Post installation testing shall be conducted by the contractor on 25% of the storm sewer system at segments chosen by the Engineer no less than thirty days after installation. Deflections shall not exceed 7.5 percent of the nominal diameter. If any segments fail post installation testing, the Engineer, at his discretion, may require contractor to perform post installation testing on any additional segments or all of the remaining system. Pipe failing post installation testing shall be considered unacceptable.

C. For pipe diameters up to 24 inches, post installation testing shall be performed using a nine-point mandrel approved by the Engineer or by television camera. The mandrel must be pulled through the pipe by non-mechanical means.

D. For diameters including and larger than 24 inches, the contractor has the option of performing post installation testing by mandrel, physical measurement or television camera.

3.11 CLEAN-UP

A. The Contractor shall maintain the work area in a clean and presentable condition during his work operation and shall clear the area of surplus construction materials, debris and rubbish resulting from his operations. The site shall be left in a satisfactory clean and neat appearance.

END OF SECTION