

Project Manual

TECH SINGLE USER RESTROOM REMODELING

St. Cloud, Minnesota



St. Cloud

505 W Saint Germain. #200

St. Cloud, MN 56301

p 320.408.7008

Project Number: JLG 250238

Date: November 14, 2025

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SECTION 00 0105 - CERTIFICATIONS PAGE

TECH SINGLE USER RESTROOM REMODELING

ST. CLOUD, MINNESOTA

CERTIFICATIONS

Architect

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 Architect under the laws of the State of Minnesota.



Erin Sebring, AIA
Reg. No. 59117

November 14, 2025

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 Professional Engineer under the laws of the State of Minnesota.



Joe Nicholson, PE
Reg. No. PE-44104

November 14, 2025

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 Professional Engineer under the laws of the State of Minnesota.

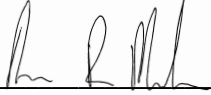


Joseph Klinkhammer, PE
Reg. No. PE-58285

November 14, 2025

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 Professional Engineer under the laws of the State of Minnesota.



Aaron Mueller, PE
Reg. No. PE-46184

November 14, 2025

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PART 1 - GENERAL

1.1 PROJECT

- A. Tech Single User Restroom Remodeling
4200 33rd Street South
St. Cloud, MN 56301

1.2 OWNER

- A. St. Cloud Area School District 742
1201 2nd Street South
Waite Park, MN 56387

1.3 PRE-BID MEETING

- A. Pre-bid meeting and site walkthrough will be on December 2nd, 2025 at 4:00 PM. Please use main entry at Tech High School

1.4 SEALED BIDS AND QUOTES DUE

- A. Thursday December 11th, 2025 no later than 2:00 PM local time.

1.5 PLACE DUE (SEALED BIDS)

A. SUBMIT BIDS IN SEALED ENVELOPE TO THE ATTENTION OF:

Amy Skaalerud at St. Cloud Area School District 742, located at 1201 2nd Street South – Waite Park, MN 56387.

- B. Bids will be opened publicly and will need to be mailed or hand delivered in a sealed envelope.
- C. Sealed bids with bid security are required for the following packages:
 - 1. 22A Mechanical
 - 2. 26A Electrical

1.6 PLACE DUE (QUOTES)

- A. Submit quotes via email to:
 - 1. Ben Omann at Bradbury Stamm Construction (bomann@bradburystamm.com)
- B. Quotes will not be opened publicly
- C. The following packages will be accepted via the quote process:
 - 1. 2A Demolition
 - 2. 6A Rough Carpentry
 - 3. 6B Casework
 - 4. 8A Hollow Metal Frames, Wood Doors, Hardware – Material Only
 - 5. 8B Storefront and Glazing
 - 6. 8C Security Gate

- 7. 9A Gypsum Assemblies
- 8. 9B Tiling
- 9. 9C Acoustical Ceiling
- 10. 9D Flooring
- 11. 9E Painting
- 12. 10 Accessories – Material Only
- 13. 10B Signage
- 14. 21A Fire Protection

1.7 TYPE OF BIDDING, AND CLASSES OF WORK

- A. Owner will accept sealed bids from Bidders for the prime contract per specification section 00 2413 Contract Bid Categories (Contracts to be awarded on a lump sum Basis).
- B. See Section 00 2413 Contract Bid Categories for further description of individual contracts.

1.8 BIDDING DOCUMENTS

Plans and Specifications for submitting bids will be available for examination and distribution on or after November 19th, 2025. Documents may be reviewed at:

- A. Electronic Documents will be available for download from Bradbury Stamm Construction smart bid web site. Please contact Ben Omann (bomann@bradburystamm.com) at Bradbury Stamm Construction to receive an invite.

1.9 BID SECURITY:

- A. Required for all contracts. Submit certified check or acceptable Bidder's Bond payable to Owner in an amount equal to Five Percent (5%) of Total Base Bid, including alternates with each Bid per Instructions to Bidders.
 - 1. Bid security is required for the following packages:
 - a. 22A Mechanical
 - b. 26A Electrical
 - 2. Bid security is not required for the following packages:
 - a. 2A Demolition
 - b. 6A Rough Carpentry
 - c. 6B Casework
 - d. 8A Hollow Metal Frames, Wood Doors, Hardware – Material Only
 - e. 8B Storefront and Glazing
 - f. 8C Security Gate
 - g. 9A Gypsum Assemblies
 - h. 9B Tiling
 - i. 9C Acoustical Ceiling
 - j. 9D Flooring
 - k. 9E Painting
 - l. 10 Accessories – Material Only
 - m. 10B Signage
 - n. 21A Fire Protection

1.10 RESPONSIBLE CONTRACTOR ACT:

- A. Required for all contracts \$50,000 and higher. Bidders are required to comply with the Minnesota Responsible Contractors Act (16C.285). Contractor's whose bid is greater than \$50,000 are to include the verification of Compliance.

1.11 PERFORMANCE BOND

- A. Performance Bond is required for all contracts \$175,000 and higher.
- B. Performance Bond is required in amount of 100 percent of Contract amount, including alternates.

1.12 PREVAILING WAGE

- A. There are no prevailing wage requirements for this project

1.13 REJECTION

- A. Owner reserves the right to reject any or all proposals and to waive Bidding formalities, and to award prime contracts to Bidder that Owner finds to their best advantage.
- B. Each Bidder agrees to waive any claim it has or may have against Owner, Architect, Engineer, and their respective employees, arising out of or in connection with administration, evaluation, or recommendation of any Bid.

1.14 PRIOR APPROVAL

- A. This Contract has a 7-calendar day prior approval clause for product Substitutions.

END OF SECTION



AIA[®] Document A701[™] – 2018

Instructions to Bidders

for the following Project:

(Name, location, and detailed description)

Tech Single User Restroom Remodeling
4200 33rd Street South
St. Cloud, MN 56301

THE OWNER:

(Name, legal status, address, and other information)

Independent School District #742
1201 2nd Street South
Waite Park, MN 56387

THE ARCHITECT:

(Name, legal status, address, and other information)

JLG Architects
505 West Saint Germain Street – Suite 200
St. Cloud, MN 56301

ADDITIONS AND DELETIONS:

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

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

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

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

TABLE OF ARTICLES

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2	BIDDER'S REPRESENTATIONS
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ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

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

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

Refer to 00 1113 Advertisement for Bid

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

Requests for clarification should be via email

§ 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 seven (7) days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

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

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

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

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

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

§ 3.4 Addenda

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

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

Refer to 00 1113 Advertisement for Bid

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

Refer to 00 1113 Advertisement for Bid

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

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

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning 60 days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

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

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Refer to 00 1113 Advertisement for Bid

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

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

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

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

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

Bid security will be retained by Construction Manager

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

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

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

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. In the event of either withdrawal or disqualification, bid security will not be forfeited.

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

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

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

N/A

- .5 Drawings

Number

Title

Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages
TBD		

.8 Other Exhibits:

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

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

☐ The Sustainability Plan:

Title	Date	Pages

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

SECTION 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Requirements for submitting substitution requests for materials, products, equipment and methods of construction from those required by the Procurement Documents, during the procurement phase and prior to execution of the Owner/Contractor Agreement.

1.02 SUBSTITUTIONS (DURING THE PROCUREMENT/BIDDING PHASE)

- A. The technical specification sections may have several materials, products, equipment and methods of construction specified under the same heading. Selection of a specified materials, products, equipment and methods of construction shall be at the option of the Bidder. Where materials, products, equipment and methods of construction are specified accompanied with the phrase "Or Equal", "Approved Substitution", or similar verbiage, the Bidder may submit materials, products, equipment and methods of construction for approval in accordance with the requirements of this Document.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect (or Construction Manager as applicable) at least seven working days prior to the date for receipt of Bids.
 - 1. Submit each request for substitution on the Architect's "Procurement Substitution Request Form" included at the end of this Section.
 - 2. Submit one material, product, equipment and methods of construction per request form, either duplicated from the Project Manual or available from the Architect's office.
 - 3. Submittals not accompanied by this form properly filled in and endorsed, will be discarded without review. NO EXCEPTIONS.
 - 4. Where specified materials, products, and equipment are accompanied by a color, pattern or finish selection, requests for substitution shall include an actual sample of the proposed color, pattern or finish for review.
 - 5. Where multiple materials, products or equipment are specified within a single specification section, specifically identify which product you wish to substitute.
- C. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or rejection of a proposed substitution shall be final.
- D. Materials, products, equipment and methods of construction approved by this substitution procedure will be issued in an Addendum.
- E. Refer to Section 01 2500 for requests for substitutions after execution of the Owner/Contractor Agreement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PROCUREMENT SUBSTITUTION REQUEST FORM

TO: JLG Architects
505 W Saint Germain Street, Suite 200
St. Cloud, MN 56301

Phone: 612-314-4748
Contact: Erin Sebring
esebring@jlgarchitects.com

PROJECT: Tech Single User Restroom Remodeling, St. Cloud, Minnesota

Section Number _____ Section Title _____

Specified Product _____

Proposed Substitution _____

All of the following questions must be answered. Incomplete forms will not be reviewed.

1. The following supporting data is attached:
☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
2. Does the proposed substitution affect dimensions shown on Drawings, or functional clearances?
☐ YES ☐ NO
3. Does the proposed substitution change the design or details shown on the Drawings?
☐ YES ☐ NO
4. Does the proposed substitution affect other trades?
☐ YES ☐ NO
5. Does the proposed substitution affect maintenance service, or source of replacement parts, if applicable?
☐ YES ☐ NO
6. Does the proposed guarantee or warranty differ from that specified?
☐ YES ☐ NO
7. If "YES" to Items 2, 3, 4, 5 or 6 above, attach a thorough explanation on your company letterhead.
8. If there are other major differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead.
9. The proposed substitution was used within the last 24 months on the following project:
Project Name _____
Location _____
Architect _____ Telephone No. _____
10. Has the proposed substitution been used on a JLG Architects project within the last 12 months?
☐ YES ☐ NO; If yes, which project? _____
11. The undersigned states that the function, appearance and quality of the substitution item are equivalent or superior to the specified item.

Submitted By: Firm _____ Signature _____
Address _____
Telephone _____ Fax _____
Date _____ E-Mail _____

For Use By Design Consultant: ☐ Accepted ☐ Accepted As Noted ☐ Not Accepted ☐ Received Too Late

Name _____ Signature _____

Date _____ Remarks _____

SECTION 00 4113 - BID FORM

BID DATE: Thursday, December 11th, 2025, not later than 2:00 PM local time.

TO: Attn: Amy Skaalerud
St. Cloud Area School District #742
1201 2nd Street South
Waite Park, MN 56387

PROJECT: Tech Single User Restroom Remodeling
4200 33rd Street South
St. Cloud, MN 56301

ARCHITECT: JLG Architects
505 West Saint Germain Street – Suite 200
St. Cloud, MN 56301

The undersigned, having become familiar with site of proposed Project and Bidding and Contract Documents for Project noted above, hereby proposes to provide Work per Contract Documents at Sum stated below.

CONTRACTORS NAME: _____

ADDENDA

Bidder hereby acknowledges receipt of the following Addenda. Modifications to Bid Documents noted therein have been considered and cost thereto is included in Base Bid Sum

Addendum Numbers _____

BASE BID

Bid Category: _____ Description: _____

(Provide Bid Category Number and Description as it appears in 00 2413)

Bidder agrees to provide the work for the Bid Category above for the lump sum of:

(\$ _____) _____
(Number) (Words)

BID SECURITY

Accompanying this proposal is the Bid Security specified in Advertisement for Bids, the same being subject to forfeiture in the event of default by the undersigned.

ACKNOWLEDGMENTS

Bidder, in submitting this Bid, certifies that Bid is based upon careful examination of Bidding and Contract Documents and waives all rights to plead any misunderstanding.

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 or combination.

Bidder, in submitting this Bid, acknowledges that Bidder has read and fully understands Project Manual Document 001113- Advertisement for Bids.

RESPONSIBLE CONTRACTOR: By submitting a bid for the above-named project, per Minnesota State Statute Chapter 16C.285-RESPONSIBLE CONTRACTOR REQUIREMENT DEFINED, the undersigned is confirming that the Contractor meets the minimum criteria defining a Responsible Contractor as listed in Minnesota State Statute Chapter 16C.285 – RESPONSIBLE CONTRACTOR REQUIREMENT DEFINED. Subdivision 3. Minimum Criteria

CONTRACTOR PERSONNEL

Project Manager's Name: _____

Project Manager's Email: _____

BIDDER IDENTIFICATION

THE UNDERSIGNED operates as:

() incorporated in the State _____ () a Partnership () a Proprietorship

LEGAL NAME OF PERSON, FIRM OR CORPORATION

Legal Name: _____

Address: _____

Telephone: _____ Facsimile. _____

E-mail: _____

By: _____ Title: (Signature of Authorized Signing Officer)

Company License No.: _____

Federal ID Number (if applicable) _____

RESPONSIBLE CONTRACTOR ACT – VERIFICATION OF COMPLIANCE

STATE OF MINNESOTA)

) ss.

COUNTY OF _____)

Project Name and Number: _____

I, _____, solemnly affirm under oath that I am an owner or officer of
_____ (“the Contractor”) and state under oath that:

1. The Contractor meets all of the minimum criteria established in subdivision 3 of the Minnesota Responsible Contractor Law, Minnesota Statute section 16C.285; and any additional criteria that the contracting authority has included in the definition of responsible contractor in the bidding documents.
2. All subcontractors that the Contractor intends to retain have verified to the Contractor through a signed statement under oath by an owner or officer that they also meet the same minimum criteria, and that they have listed the subcontractors they intend to retain. Subject to the Contractor’s right to add subcontractors, those subcontractors are:

3. I declare under penalty of perjury that, to the best of my knowledge, everything I have stated in this document is true.

Title: _____

Subscribed and sworn to before me this__day
of_____20 _____

Notary Public

END OF SECTION

SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.01 DESCRIPTION OF ALTERATIONS WORK

1.02 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.03 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Existing building spaces may not be used for storage.
- D. Utility Outages and Shutdown:
 - 1. Limit disruption of utility services to hours the building is unoccupied.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 3. Prevent accidental disruption of utility services to other facilities.

END OF SECTION

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 00 2600 - Procurement Substitution Procedures: Required form for substitutions requests made before the end of bidding (during procurement).
- B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 REFERENCE STANDARDS

- A. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Where a product requirement includes sustainability documentation, this documentation is required to be included in the substitution request. If documentation is not included, the substitution will be rejected. See individual Specification Sections sustainability requirements.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms included in the Project Manual are adequate for this purpose, and must be used.
- E. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Section 00 2600 - Procurement Substitution Procedures specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Architect will consider requests for substitutions only within 30 days after date of Agreement. Requests for substitutions after the bids have been received are done so at the risk of the Contractor. Substitutions may not be granted.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- D. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.
 - 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

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

END OF SECTION

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Submittals for review, information, and project closeout.
- C. Number of copies of submittals.
- D. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare in a format and with content acceptable to Owner.
 - 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

- d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
- 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
 - 5. Identify and include improper or frivolous RFIs.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.02 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - 1. Coordinate with Contractor's construction schedule and schedule of values.

2. Format schedule to allow tracking of status of submittals throughout duration of construction.
3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.03 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.04 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

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

3.06 NUMBER OF COPIES OF SUBMITTALS

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

3.07 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. Color selections will not be reviewed or approved until all related products are submitted to ensure a cohesive palette.
 - d. Products that make up a system, assembly, or that are directly related to each other often must be reviewed together. Review will not begin until all components are submitted.
 - e. Coordinate with Architect and/or Construction Manager, as applicable, where schedule dictates an expedited review of products.
 - 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 7. Provide space for Contractor and Architect review stamps.
 - 8. When revised for resubmission, identify all changes made since previous submission.
 - 9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 - 10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - 2. Collect required information into a single submittal.
 - 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
- E. Do not use shop drawings without an appropriate final stamp indicating action taken in connection with construction.

3.08 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

END OF SECTION

SECTION 01 3329 - SUSTAINABILITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes requirements to implement sustainable design intent.

1.02 MEETINGS

- A. Include these requirements on kick-off meeting and progress meeting agendas.

1.03 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: General submittal requirements.
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Section 01 7419 - Construction Waste Management and Disposal.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for additional submittal procedures requirements.
- B. Submit documentation specified in this Section and in applicable individual Sections.
- C. One or more of the following documents shall be submitted when indicated in individual Sections:
 - 1. Environmental Product Declarations (EPD).
 - 2. Health Product Declarations (HPD).
 - 3. Declare product labels showing Red List Free or Red List Approved.
 - 4. Forest Stewardship Council (FSC).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 4533 - Code-Required Special Inspections and Procedures.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.
- D. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

1.03 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.

- j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

3.02 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
 - 9. Submit a written report in binder form with an index at the conclusion of the work required by the Testing Agency. The report shall be submitted as a permanent record to the Owner, through the Structural Engineer, of all tests, logs, comments and written reports.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide delivery of samples to testing laboratories.
 - e. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Each Prime Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
6. Each Prime Contractor and each agency engaged to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with minimal delay.
7. Each Prime Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
8. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
9. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing: The Contractor is responsible for re-testing where results of required inspections, tests, or similar services prove unsatisfactory or do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
- F. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- G. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.
- H. 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.

3.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 1. Observer subject to approval of Architect.
 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

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

END OF SECTION

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 00 2600 - Procurement Substitution Requirements: Requests for substitution during the bidding process.
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 4000 - Quality Requirements: Product quality monitoring.
- D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 2. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 3. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
 - 4. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 REFERENCE STANDARDS

- A. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).
- B. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.
- C. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).

- D. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).
- E. ISO 21930 - Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services; 2017.

1.05 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 30 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- E. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.06 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
 - 2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
- D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
- E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - 1. Name of product and manufacturer.
 - 2. Model and serial number.
 - 3. Capacity.
 - 4. Speed.

5. Ratings.
- F. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
 1. Good: Product-specific; compliant with ISO 14044.
 2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
 3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
 4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.
- G. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.
- H. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber sourced and labeled by an organization accredited by one of the following:
 1. Wood sourced from a sustainable harvested location. Submit any documentation available.
 2. Chain of Custody documents are not required.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 1. Provide products complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 2. Semi proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
 - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Documents provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 3. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are

recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

- a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
5. Compliance with Standards, Codes, and Regulations: Where the Specifications only require compliance with an imposed code, standard, or regulation select a product that complies with the standards, codes, or regulations specified.
6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
7. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

2.02 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.03 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 1. Made using or containing CFC's or HCFC's.
 2. Made of wood from newly cut old growth timber.
 3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 4. Have longer documented life span under normal use.
 5. Result in less construction waste. See Section 01 7419
 6. Are made of vegetable materials that are rapidly renewable.
 7. Are made of recycled materials.
 8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
 9. Have a published Environmental Product Declaration (EPD).
 10. Have a published Health Product Declaration (HPD).
 11. Are Living Building Challenge Red List Free.
 12. Have a published Declare Label.

2.04 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.05 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- B. Store and protect products in accordance with manufacturers' instructions.

- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Do not store products directly on the ground.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

3.05 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
- B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT

RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Composite wood.
 - 5. Products making up wall and ceiling assemblies.
 - 6. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
 - 4. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Metals that are plated, anodized, or powder-coated.
 - 3. Glass.
 - 4. Ceramics.
 - 5. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.
- D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- F. CHPS (HPPD) - High Performance Products Database; Current Edition.
- G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.
- H. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).
- J. SCS (CPD) - SCS Certified Products; Current Edition.
- K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:

- a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
 - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Joint Sealants: SCAQMD 1168 Rule.
 - 3. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - 4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Cutting and patching.
- D. Cleaning and protection.
- E. Starting of systems and equipment.
- F. Demonstration and instruction of Owner personnel.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- D. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.06 COORDINATION

- A. See Section 01 1000 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

- A. Promptly notify Architect of any discrepancies discovered.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- C. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
 - 3. Relocate items indicated on drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 1000 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 1. Complete the work.

2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
 - E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
 - F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
 - G. Restore work with new products in accordance with requirements of Contract Documents.
 - H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
 - I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
 - J. Patching:
 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.

- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood: May be used as blocking or furring.
 - 5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
- E. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 01 2500 - Substitution Procedures.
- C. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- D. Section 01 6000 - Product Requirements: Waste prevention requirements related to product substitutions.
- E. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- F. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 6000 and Section 01 2500.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 - 3. Proposed disposal method for waste product.
 - 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

- C. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

END OF SECTION

SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 3. Field changes of dimension and detail.
 4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
 - C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
 - D. Include color coded wiring diagrams as installed.
 - E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 - F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - G. Provide servicing and lubrication schedule, and list of lubricants required.
 - H. Include manufacturer's printed operation and maintenance instructions.
 - I. Include sequence of operation by controls manufacturer.
 - J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - K. Provide control diagrams by controls manufacturer as installed.
 - L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
 - M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - O. Include test and balancing reports.
 - P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
 - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with requirements in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Protect existing structures and other elements to remain in place and not removed.

1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- F. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Comply with requirements of Section 01 7419 - Construction Waste Management and Disposal.
 2. Dismantle existing construction and separate materials.
 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.02 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 1. Verify construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
 1. Provide, erect, and maintain temporary dustproof partitions of construction indicated on drawings .
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- D. Remove existing work as indicated and required to accomplish new work.
 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
 2. Remove items indicated on drawings.
- E. Protect existing work to remain.
 1. Prevent movement of structure. Provide shoring and bracing as required.
 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.

4. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 1000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.2 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.

1.3 RELATED REQUIREMENTS

- A. Section 01 45 33 - Structural Testing and Special Inspection.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 03 30 00 - Cast-in-Place Concrete.
- D. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-inplace concrete.

1.4 REFERENCE STANDARDS

- A. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- B. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- D. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

1.5 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.6 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Submit product data for form release agents.

1.7 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI PRC-347, ACI SPEC-301, and ACI 318.

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. Chamfer exposed outside corners of beams, joists, columns, and walls 3/4".
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- E. Comply with relevant portions of ACI SPEC-301.

2.2 FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.

2.3 FORMWORK ACCESSORIES

- A. 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.
- B. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Establish a bench mark in an accessible location and use as a reference point for various construction levels. Maintain in an undisturbed condition until final completion.
- B. 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 SPEC-301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Lay out all work and check general building lines and levels established. Coordinate layout and measurements and if discrepancies arise, report them to the Architect.
- D. Keep wood forms wet as necessary to prevent shrinkage.
- E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

- F. Align joints and make watertight. Keep form joints to a minimum.
- G. Obtain approval before framing openings in structural members that are not indicated on drawings.
- H. Coordinate this section with other sections of work that require attachment of components to formwork.
- I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.
- J. Protect work at all times against the elements and other hazards. Cover and secure work.

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.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

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. Place and secure anchor rods and structural steel embeds before concrete is placed. "Wet sticking" of these elements is not permitted.
- E. 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.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI SPEC-117. See section 03 30 00 for additional requirements.
 - 1. Provide Class B surface for exposed concrete.
 - 2. Provide Class C or Class D surface for concealed concrete.
- B. Tolerances given in ACI SPEC-117 are not cumulative. Maximum tolerance for any formed surface, except footings, shall be one inch.

3.8 FIELD QUALITY CONTROL

A. Structural Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 45 33.
2. Formwork for slabs on grade, strip footings without transverse reinforcement, isolated spread footings, and topping slabs does not require inspection except at storm shelter(s). Additional exceptions may be noted on the structural drawings.
3. Personnel Qualifications: Special Inspector – Structural I: ICC certified concrete inspector or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with the experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 45 33. The licensed engineer shall review and approve all inspection reports.
4. The Owner will provide the following inspections:
 - a. Verify formwork for all concrete, except as noted above, will result in member size, location, and configuration as described on the contract documents, only as it affects the structural integrity of the concrete elements to be placed. Verify removal of shoring conforms to this section. Qualifications: Structural I.
 - b. Verify placement of anchor rods and other embedments supporting structural steel for compliance with the construction documents. At a minimum, the diameter, grade, type and length of the anchor rod or embedded item, and the extent or depth of embedment into the concrete, shall be verified and documented prior to placement of concrete. Qualifications: Structural I.

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. Forms for sides of beams, columns, and footings shall remain in place for a minimum of 24 hours.
- C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- D. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

SECTION 03 1510 - POST-INSTALLED ANCHORS

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Requirements pertaining to post-installed anchors for materials and equipment. This section pertains to Divisions 3, 4, 5, and 6 of these specifications that require post-installed anchors, unless specified otherwise.

1.3 RELATED REQUIREMENTS

- A. Section 01 45 33 - Structural Testing and Special Inspection.
- B. Section 03 30 00 – Cast-in-Place Concrete
- C. Section 04 29 00 – Structural Unit Masonry
- D. Division 5 – Metals

1.4 REFERENCES

- A. ACI 318-14 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018). 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 B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- E. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel; 2021.
- F. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- G. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.
- H. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020. I. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).
- J. ICC-ES AC58 - Acceptance Criteria for Adhesive Anchors in Cracked and Uncracked Masonry Elements; 2022.
- K. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).
- L. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).
- M. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.
- N. ACI 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete; 2019.
- O. Federal Specifications A-A-1922A, A-A01923A and A-A-55614 for Expansion and Shield-Type Anchors

1.5 QUALITY ASSURANCE

- A. Post-Installed anchors and related materials shall be listed by one or more of the following agencies, as applicable:
1. ICC Evaluation Service
 2. Underwriters Laboratories (UL) and/or Factory Mutual (FM)
 3. IAPMO Evaluation Service

1.6 SUBMITTALS

- A. Product Data: Submit data for proprietary materials, manufacturer's specifications (including finishes and/or materials), Material Safety Data Sheets (MSDS) and installation procedures. B. Test Reports: ICC-ES or IAPMO-UES listings.

1.7 SUBSTITUTIONS

- A. Only manufacturers with an ICC-ES or IAPMO listing will be considered for substitution requests.
- B. The contractor shall submit for Engineer-of-Record's review, calculations that are prepared & sealed by a registered Professional Engineer demonstrating that the substituted product is capable of achieving the pertinent equivalent performance values of the specified product using the appropriate design procedure and/or standard(s) as required by the Building Code. In addition, the calculations shall specify the diameter and embedment depth of the substituted product.
- C. Any increase in material costs for such submittal shall be the responsibility of the contractor.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Expansion Anchors
1. Concrete Wedge Anchors (expansion bolt):
 - a. Carbon steel, ASTM B633 , Class SC1, Type I or III.
 - b. Stainless steel anchors (where noted): ASTM F593, Type 303, 304 or 316.
 - c. Evaluation report issued by ICC-ES or IAPMO required.
 - d. Tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2 and ICC-ES AC193 for all mandatory tests .
 - e. Acceptable products include:
 - 1) Simpson Strong-Tie: Strong-Bolt 2 (ICC-ES ESR-3037) 2) Hilti: Kwik Bolt TZ2 (ICC-ES ESR-4266).
 - 3) DeWalt: Power-Stud+ SD2 (ICC-ES ESR-2502).
 2. Masonry Wedge Anchors (expansion bolt): Federal Specification A-A-1923A, Type 4.

- a. Carbon steel, electroplated zinc finish unless otherwise noted.
- b. Mechanically galvanized (where noted): ASTM B695, Class 55, Type 1.
- c. Stainless steel anchors (where noted): ASTM F593, Type 303, 304 or 316.
- d. Evaluation report issued by ICC-ES or IAPMO required.
- e. Tested in accordance with ICC-ES AC01 for all mandatory tests :
- f. Acceptable Products Include:

- 1) Simpson Strong-Tie: Strong Bolt 2 (IAPMO ER-240) 2)
- Hilti: Kwik Bolt TZ2 (ICC-ES ESR-4561).

B. Adhesive Anchors

- 1. Adhesive anchors consist of an insert and an adhesive.
- 2. Inserts
 - a. Threaded Rod Inserts: Provide preparation or configuration as recommended by manufacturer.
 - 1) Interior Exposure: ASTM F1554.
 - b. Reinforcing Bar Inserts: ASTM A615/A615M or ASTM A706/A706M. Provide preparation or configuration as recommended by manufacturer.
 - c. Proprietary Rod Inserts: Provide where shown.
 - 1) Hilti: HIT-TZ
 - 2) Simpson Strong-Tie: IXP
- 3. Adhesives for Concrete:
 - a. Evaluation report issued by ICC-ES or IAPMO required.
 - b. Tested and qualified for use in cracked and uncracked concrete in accordance with ICC-ES AC308 for all mandatory and optional seismic tests including creep tests.
 - c. Epoxy: ASTM C881/C881M Type IV, Grade 3, Class B and C.
 - 1) Acceptable products include:
 - (a) Simpson Strong-Tie: SET XP (ICC-ES ESR-2508).
 - (b) Simpson Strong-Tie: ET-HP Epoxy (ICC-ES ESR-3372).
 - (c) Hilti: HIT-RE 500 V3 (ICC-ES ESR-3814).
 - (d) DeWalt: PURE220+ (ICC-ES ESR-5144).
 - (e) DeWalt: PURE110+ (ICC-ES ESR-3298).
 - (f) ITW Red Head: Red Head G5+ (ICC-ES-ESR-4138). (g) ITW Red Head: Red Head C6+ (ICC-ES ESR-4046).
 - d. Acrylic: Cartridge type, two-component, acrylic based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Minimum physical requirements of ASTM C881/C881M Type IV, Grade 3, Class A, B and C.

- 1) Acceptable products include:
 - (a) Hilti: HIT-HY 200 V3 (ICC-ES ESR-4868).
 - (b) DeWalt: AC100+ Gold (ICC-ES ESR-2582).
 - (c) Simpson Strong-Tie: AT-XP (IAPMO ER-263).
 - (d) ITW Red Head: Red Head A7+ (ICC-ES ESR-3903).
4. Adhesives for Solid Concrete Masonry:
 - a. Evaluation report issued by ICC-ES or IAPMO required.
 - b. Tested in accordance with ICC-ES AC58 for all mandatory tests and the following optional tests:
 - 1) Seismic tests
 - 2) Creep tests
 - 3) Dampness tests
 - 4) Freeze-thaw tests
 - c. Epoxy: ASTM C881/C881M Type IV, Grade 3, Class B and C.
 - 1) Acceptable products include:
 - (a) Simpson Strong-Tie: ET-HP Epoxy (ICC-ES ESR-3638).
 - d. Acrylic: Cartridge type, two-component, acrylic based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Minimum physical requirements of ASTM C881/C881M Type IV, Grade 3, Class A, B and C.
 - 1) Acceptable products include:
 - (a) Simpson Strong-Tie: AT-XP (IAPMO ER-281).
 - (b) Hilti: HIT-HY 200 (ICC-ES ER-3963).
 - (c) ITW Red Head: Red Head A7+ (ICC-ES ESR-3951).
 5. Adhesives for Hollow Concrete Masonry:
 - a. Evaluation report issued by ICC-ES or IAPMO required.
 - b. Tested in accordance with ICC-ES AC58 for all mandatory tests and the following optional tests:
 - 1) Seismic tests
 - 2) Creep tests
 - 3) Dampness tests
 - 4) Freeze-thaw tests
 - c. Epoxy: ASTM C881/C881M Type IV, Grade 3, Class B and C.
 - 1) Acceptable products include:

- (a) Simpson Strong-Tie: SET XP High-Strength Adhesive (IAPMO UES ER-265). (b) Hilti: HIT-HY 270 and HIT-SC Screen Tubes (ICC-ES ESR-4143).

C. Concrete Screw Anchors

1. Concrete Screw Anchors:

- a. Carbon steel heat-treated or hardened.
- b. Zinc-plated in accordance with ASTM B633, Class SC1, Type I or equivalent coating.
- c. Mechanically galvanized (where noted): ASTM B695, Class 55, Type 1.
- d. Evaluation report issued by ICC-ES or IAPMO required.
- e. Tested and qualified for use per ICC-ES AC193 for all mandatory tests .
- f. Acceptable products include:
 - 1) Simpson Strong-Tie: Titen HD (ICC-ES ESR-2713).
 - 2) Hilti: Kwik HUS-EZ (ICC-ES ESR 3027).
 - 3) DeWalt: Screw-Bolt+ (ICC-ES ESR-3889).

2. Masonry Screw Anchors: (Grouted Masonry Only)

- a. Carbon steel heat-treated or hardened.
- b. Zinc-plated per ASTM B633, Class SC1, Type I, or equivalent coating.
- c. Mechanically galvanized (where noted): ASTM B695, Class 55, Type 1.
- d. Evaluation report issued by ICC-ES or IAPMO required.
- e. Tested per ICC-ES AC106 for all mandatory tests (and seismic tests):
- f. Acceptable products include:
 - 1) Simpson Strong-Tie: Titen HD (ICC-ES ESR-1056).
 - 2) Hilti: Kwik HUS-EZ (ICC-ES ESR-3056).
 - 3) DeWalt: Screw-Bolt+ (ICC-ES ESR-1678).
 - 4) ITW Red Head: Tapcon (ICC-ES ESR-1671).

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install anchors in strict accordance with manufacturer's printed instructions and, where required, requirements of ICC-ES evaluation reports.
- B. Conform to manufacturer's requirements for, but not limited to, hole drilling methods, hole size, hole cleaning, substrate and adhesive temperatures, moisture presence in holes, and required edge distance and spacing. Unless noted otherwise, dry holes are required.
- C. Use special tools when recommended by manufacturer for installation of anchors unless otherwise permitted specifically by the Engineer or Architect of Record.
- D. Drill holes in concrete and masonry, in accordance with the manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer shall, on request, provide the services of a field representative to demonstrate to and train installers in proper installation techniques.
- B. Structural Testing and Special Inspection
 - 1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 45 33.
 - 2. Special Inspection, periodic or continuous, of post-installed anchors shall be provided as specified herein, but not less than as required by ICC-ES evaluation reports.
 - 3. Definitions: ASNT - American Society for Non-Destructive Testing
 - 4. Personnel Qualifications
 - a. Special Inspector Technical I: ASNT Level I, employed by a testing agency and supervised by an ASNT Level III with a minimum of 10 years experience.
 - b. Special Inspector Technical II: ASNT Level II, employed by a testing agency and supervised by an ASNT Level III with a minimum of 10 years experience.
 - c. Special Inspector – Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in design of structural systems of the project type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 45 33. The licensed engineer shall review and approve all inspection reports.
 - 5. The Owner will provide the following tests and inspections:
 - a. Continuous special inspection during installation to verify materials delivered to site comply with contract documents, bolt type and dimensions, concrete type and compressive strength, pre-drilled hole dimensions and cleaning, embedment, spacing, edge distances, slab thickness, tightening torque, and any other items requiring inspection by product's ICC approval report. Qualifications: Technical II or Structural I.

END OF SECTION

SECTION 03 2000 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Reinforcing steel for masonry.
- C. Supports and accessories for steel reinforcement.

1.3 RELATED REQUIREMENTS

- A. Section 01 45 33 - Structural Testing and Special Inspection.
- B. Section 03 10 00 - Concrete Forming and Accessories.
- C. Section 03 15 10 - Post-Installed Anchors.
- D. Section 03 30 00 - Cast-in-Place Concrete.

1.4 REFERENCE STANDARDS

- A. ACI PRC-315 - Guide to Presenting Reinforcing Steel Design Details; 2018
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- F. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.
- G. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.
- H. CRSI (DA4) - Manual of Standard Practice; 2023.
- I. CRSI (P1) - Placing Reinforcing Bars, 10th Edition; 2019.

1.5 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Shop Drawings: Follow recommended practices of ACI PRC-315. Include size, length, bar schedules, shapes of bent bars, spacing of bars, methods of supporting reinforcing, and location and length of splices. Provide details as necessary to show final position of reinforcement in elements.
 - 1. Include shop drawings for masonry reinforcing

2. If shop drawings are resubmitted after the original review, identify all changes made to the shop drawings after the original submittal with clouds or similar markings.

1.6 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301 and ACI 318.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver all reinforcement to the Project site bundled, tagged, and marked.
- B. Store all reinforcing steel bars, ties, wire fabric, etc., on the site in a manner that will permit access for proper inspection and identification.
- C. Do not exceed design capacity of existing construction or formwork.
- D. Store reinforcing to avoid contact with mud, grease, or other materials that would affect bond.
- E. Special handling for epoxy coated reinforcing to include:
 1. Support epoxy-coated bars or bundles of bars to prevent damage to coating during transit.
 2. Store epoxy-coated bars on protective cribbing.
 3. Lift bundles of epoxy-coated bars at multiple pickup points to minimize bar-to-bar abrasion due to sags in the bundles.
 4. Do not drop or drag epoxy-coated bars or bundles of bars.
 5. Provide padded contact areas on equipment used for handling epoxy-coated bars.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 1. Deformed billet-steel bars.
 2. Unfinished.
 3. Epoxy coated in accordance with ASTM A775/A775M where noted.
- B. Reinforcement

Accessories:

1. Chairs, Bolsters, Bar Supports, Spacers: CRSI MSP-1 Chapter 3. Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Class 1 for all surfaces exposed to weather.
 - b. Class 1 or 2 for interior surfaces exposed to view.
 - c. Class 3 for surfaces not exposed to view.
2. Bar Supports and Accessories for epoxy coated bars: CRSI MSP-1 Chapter 3, Class 1A epoxy, vinyl, or plastic coated, all plastic supports, or precast supports with epoxy or plastic coated wire.
 - a. Use epoxy-coated reinforcing bars as support bars.

- b. Fasten epoxy-coated reinforcing bars to bar supports, accessories, and each other with nylon, epoxy or plastic coated tie wire.
- 3. Patching Materials for Epoxy Coated Bars: ASTM D3963/D3963M Annex A1, inert in concrete.
- 4. Mechanical couplers: Develop 125% of yield strength, ICBO approved. Dayton/Richmond: Barlock Coupler System, Erico: Lenton Couplers, or approved equal.
- 5. Post-installed reinforcing adhesive: See section 03 15 10.

2.2 DETAILING

- A. Detail reinforcing steel in accordance with ACI PRC-315 and ACI 318.
- B. Splice reinforcing where indicated on drawings. Specifically note proposed splices not shown on the drawings on the shop drawings and highlight for reviewer's acceptance.
- C. Provide epoxy coated reinforcing for all concrete exposed to weather such as exterior walls, slabs, columns, piers, landings, stoop slabs, loading docks, and stairs. Additional locations may be noted on the drawings. Building foundation walls do not require epoxy coated reinforcing unless shown on the drawings.
- D. Provide bar supports and other accessories sufficient to maintain reinforcing within specified placing tolerances. Consider requirements of CRSI MSP-1 to be a minimum.
- E. Provide bar supports for all reinforcing, including footings, slabs on grade, grade beams, and slab temperature reinforcing.
- F. Consider normal construction activities while detailing number and type of bar supports.
- G. Detail reinforcing to accommodate forming, fabricating, and placing tolerances and maintain a minimum cover as specified.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI 318 and ACI SPEC-301.
- B. Fabricate within tolerances given in ACI SPEC-117.
- C. Welding of reinforcement is not permitted.
- D. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

PART 3 EXECUTION

3.1 PREPARATION - PLAIN BARS

- A. Clean all reinforcement before placing. Remove oil, mill scale, pitting, mud, loose rust, strong alkali or organic matter.
- B. Remove all excessive rust with wire brush or by sandblasting.
- C. Reinforcement with rust and/or mill scale shall be acceptable if a hand-brushed test specimen meets the applicable ASTM requirements for dimension, weight, and height of deformations.

3.2 PREPARATION - EPOXY COATED BARS

- A. Repair coating damage larger than 0.1 square inch in accordance with patching material manufacturer's recommendations.

- B. Remove oil, mud, strong alkali, or organic matter prior to placement in forms.

3.3 PLACEMENT

- A. Place reinforcing in accordance with approved shop drawings, support and secure reinforcement against displacement. Do not deviate from required position. Place within maximum tolerances given in ACI SPEC-117. Bars must be placed and secured before concrete is placed.
- B. Splice reinforcing where indicated on drawings.
- C. Install mechanical connectors in accordance with connection manufacturer's recommendations.
- D. Provide templates for all column dowels.
- E. Do not bend bars embedded in hardened or partially hardened concrete without approval from the Architect/Engineer. If bending is permitted, conform to procedures of ACI SPEC-301.
- F. Support footing and slab on grade reinforcing. Do not lift or "step in" during placement of concrete. Use precast concrete, block, brick, or wire supports with earth bearing bases.
- G. Do not displace or damage vapor barrier.
- H. Reinforcing shall have the minimum concrete cover as given on the drawings.

3.4 INSTALLATION - EPOXY COATED REINFORCING

- A. Do not field cut epoxy-coated reinforcing bars unless shown on Drawings or permitted by Engineer.
- B. Do not use welded splices of epoxy-coated reinforcing bars unless shown on Drawings or permitted by Engineer. When used, welded splices shall conform to AWS D1.4. Welding of crossing bars (tack welding) for assembly of epoxy-coated reinforcement is prohibited.
- C. Provide suitable ventilation when welding of epoxy-coated bars is required or permitted.
- D. Do not use mechanical connections for epoxy-coated reinforcing unless shown on drawings or permitted by Engineer.
- E. Repair coating damage due to heating, bending, cutting, welding or installation of mechanical connections, in accordance with ASTM D3963/D3963M and patching material manufacturer's recommendations.
- F. Do not use epoxy-coated bars with damage, repaired and unrepaired, exceeding 2 percent of the surface area of each bar.

3.5 POST-INSTALLED REINFORCING

- A. See section 03 15 10 for installation requirements.

3.6 FIELD QUALITY CONTROL

- A. Structural Special Inspection
 - 1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 45 33.
 - 2. Concrete reinforcing in slabs on grade, strip footings without transverse reinforcement, isolated spread footings, and topping slabs does not require inspection except at storm shelter(s). Additional exclusions may be noted on the structural drawings. Special Inspector need not be

present during entire reinforcing installation, but must observe all required reinforcing prior to concrete placement.

3. Personnel Qualifications:

- a. Special Inspector - Structural I: ICC certified concrete inspector or a graduate civil/structural engineer, or other personnel acceptable to the structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 45 33. The licensed engineer shall review and approve all inspection reports.

4. The Owner will provide the following inspections:

- a. Inspect reinforcement in all cast in place concrete. Qualifications: Structural I. Verify the following:
 - 1) Reinforcing bar grade.
 - 2) Reinforcing bars are free of oil, dirt, excessive rust, and damage.
 - 3) Reinforcing bars are adequately tied, chaired, and supported to prevent displacement during concrete placement.
 - 4) Proper chair and tie wire materials are used.
 - 5) Proper clear distances between bars and to surfaces of concrete.
 - 6) Reinforcing bar size and placement.
 - 7) Bar laps for proper length and stagger.
 - 8) Bar bends for minimum diameter, slope and length.
 - 9) Mechanical splices are placed in accordance with the plans, specifications and reviewed shop drawings.
 - 10) Epoxy coating is presented at locations noted in the plans and specifications. include tie wires, chairs, bolsters, etc. Verify coating damaged is repaired in accordance with the contract requirements.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes: Providing all items, articles and materials listed, mentioned, or scheduled on the Drawings or herein, including all labor, materials, equipment, and incidentals necessary and required for the installation of all cast-in-place concrete indicated on the Drawings or specified herein.
- B. Concrete footings
- C. Floors and slabs on grade.
- D. Concrete foundation walls.
- E. Concrete curing.

1.3 RELATED REQUIREMENTS

- A. Section 01 45 33 - Structural Testing and Special Inspection
- B. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- C. Section 03 20 00 - Concrete Reinforcing.
- D. Section 04 29 00 - Structural Unit Masonry.
- E. Section 05 12 00 - Structural Steel Framing: Embedded Structural Steel, Anchor Bolts

1.4 REFERENCE STANDARDS

- A. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- B. ACI PRC-309R - Guide for Consolidation of Concrete, American Concrete Institute; 2005
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- D. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- G. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- H. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- K. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2023.
- L. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.
- M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

- N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
- O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2023.

- P. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete; 2017a.
- Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- R. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- S. ASTM C157/C157M - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete; 2017.
- T. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
- U. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 2017a.
- V. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- W. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- X. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- Y. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.
- Z. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.
- AA. ASTM C1064/1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete; 2017.
- BB. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- CC. ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method); 2021.
- DD. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.
- EE. ASTM C1609/C1609M - Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading); 2019a.
- FF. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.
- GG. 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.
- HH. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.5 SUBMITTALS

- A. See Division 1 for submittal procedures.

- B. Concrete mix designs for each mix used. On request, include field test data used to determine required average strength (if that method was used) and field test or trial mix data used to document required average compressive strength.
- C. Product data for the following products.
 - 1. Curing materials and compounds.
 - 2. Admixtures.
 - 3. Vapor retarders.
 - 4. Non-shrink grout.
- D. Test Reports: Submit report for each test or series of tests specified.
- E. Cold weather concreting procedures.
- F. Drawings showing construction and control joint locations and details for interior supported floor slabs and slabs on grade.
- G. Certification of admixture conformance to chloride ion requirements.

1.6 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301, ACI SPEC-117, and ACI 318.
- B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

1.7 MATERIAL DELIVERY, HANDLING, AND STORAGE

- A. Materials shall be delivered in the Manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the product name, manufacturer's name, batch number, component designation, and ratio of component mixtures.
- B. Provide equipment and personnel to handle the materials by methods that prevent damage.
- C. Promptly inspect shipments to assure that materials comply with requirements, quantities are correct, and materials are undamaged.
- D. Store materials in accordance with the Manufacturer's instructions, with seals and label intact and legible. Maintain temperatures within the Manufacturer's recommended ranges.
- E. Furnish delivery tickets with each load of concrete delivered to the Project. Information on each ticket shall be as required by ASTM C94/C94M and shall also include: type of concrete (mix number), weights of all ingredients, maximum aggregate size, allowable slump range at point of discharge, type, brand, and amount of admixture, total water in the batch, maximum amount of water that can be added at the site without exceeding design mix proportions, and amount of water added at site and initials of person adding water. Retain tickets until substantial completion unless directed otherwise.

1.8 NATIONAL VOLATILE ORGANIC COMPOUND (VOC) EMISSION STANDARDS

- A. All products shall comply with the E.P.A. rulings establishing national v.o.c. emission standards for architectural coatings as listed in the Federal Register: September 11, 1998 (Volume 63, Number 176), [Rules and Regulations] [Page 48848-48887].

PART 2 PRODUCTS

2.1 FORMWORK

- A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS A.

Cement:

1. Portland Cement: ASTM C150/C150M, Type I - Normal.
2. Blended Hydraulic Cement: ASTM C595/C595M, Type IL - Portland-limestone. B. Fine

and Coarse Aggregates: ASTM C33/C33M.

1. Maximum aggregate size as specified in mix design schedule.
 2. Alkali Silicate Reactivity: Expansion of fine aggregate tested per ASTM C1260 shall not exceed 0.15 percent. If fly ash or other pozzolans are used to reduce shrinkage to meet this requirement, expansion of fine aggregate tested per ASTM C1260 without fly ash or other pozzolans shall not exceed 0.25 percent.
- C. Fly Ash: ASTM C618, Class C or F.
 - D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.4 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.
- D. Accelerating Admixture: ASTM C494/C494M Type C.
- E. Water Reducing Admixture: ASTM C494/C494M Type A.
- F. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

2.5 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; maximum water vapor permeance 0.04 perm; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Include manufacturer's recommended joint sealing tape and mastic. Tape and mastic to have maximum permeance of 0.3 perm.
- B. Granular fill under vapor retarder: Clean mixture of crushed aggregates and sand, ASTM D448, size 10, with 85-100% passing the No.4 sieve and 10-30% passing the No. 100 sieve. Meet requirements of ASTM C33/C33M for deleterious substance limits in fine aggregates.
- C. Non-Shrink Grout: ASTM C1107/C1107M; Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Conformance to ASTM C1107/C1107M shall occur with a minimum temperature range of 45°F to 90°F, a fluid consistency, and a minimum 30 minute working time.

2.6 BONDING AND JOINTING PRODUCTS

- A. Slab Isolation Joint Filler: 1/4 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

2.7 CURING MATERIALS

- A. All curing agents and sealers shall have no adverse effect on finishes, traffic topping, or other sealers. Coordinate with the appropriate finish manufacturer and receive written confirmation before applying.
- B. Moisture-Retaining Cover: ASTM C171; regular curing paper, white curing paper, white polyethylene film at temperatures above 60 degrees F., black polyethylene film at temperatures below 80 degrees F., clear polyethylene, or white burlap-polyethylene sheet at temperatures above 60 degrees F.
- C. Exterior Concrete Curing Compound: Wax base, membrane forming curing compound, ASTM C309, Type II, white pigmented.

2.8 CONCRETE MIX DESIGN REQUIREMENTS

- A. Submit concrete mix design for each type of concrete at least 30 days prior to the proposed start of placement. Mix designs must be reviewed prior to pouring concrete. Review is for conformance with specification requirements only. Contractor is responsible for performance.
- B. Concrete shall conform to the requirements of ASTM C94/C94M (Option A) unless other requirements of this project specification are more stringent.
- C. Provide concrete with workability such that it will fill the forms, without voids or honeycombs, when properly vibrated, without permitting materials to separate or excess water to collect on the surface.
- D. Slump at point of discharge: as specified by concrete supplier, 8"-10" max. for masonry grout. Include design slump in mix design submittal.
- E. Proportioning Normal Weight Concrete: ACI SPEC-301. Establish proportions based on the standard practices contained in ACI PRC-211.1.
- F. Determine required average strength as required by ACI SPEC-301 .
- G. Concrete Strength: Document that mixes produce required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
- H. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

- A. Verify that anchors, seats, plates, embeds, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement. "Wet sticking" of structural steel embeds and anchor rods is not permitted.

- B. Do not embed pipes other than non-aluminum electrical conduit or snow melting pipes in any structural concrete.
 - 1. Any pipes embedded in concrete, even those meeting the guidelines given herein, are subject to acceptance by Architect. Remove any unacceptable pipes.
 - 2. Outside diameter of pipes placed in slabs and walls shall not exceed 25 percent of the thickness of the slab or wall and shall be placed in groups of not more than 3. Space pipes within a group at not less than 4 diameters clear. Space groups of pipes at not less than 48 diameters clear.
 - 3. Maximum total dimension or area of pipes and their fittings embedded in concrete beams and columns shall not exceed, at any location, 15 percent of least section dimension or 4 percent of the gross cross sectional area.
- C. Where new concrete is to be bonded to existing or previously placed concrete, clean existing surface to remove dust, dirt, grease, oil, curing compounds and other items that would be detrimental to bonding. Saturate existing surface with clean water (8 hours minimum), remove excess water, and slush with a neat cement grout immediately before placing new concrete.
- D. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Cover sills, ledges and other surfaces with protective coverings as necessary to protect the work. E. Slabs on Grade:
 - 1. Verify subgrade compaction tests have been performed and are accepted.
 - 2. Verify subgrade is level and within acceptable tolerances.
 - 3. Verify subgrade is substantially dry with no freestanding water, muddy spots, or soft spots and is free from snow or ice.
 - 4. Verify completion of all underfloor mechanical and electrical work.
 - 5. Provide 3 inch minimum cover bottom and 3 inch minimum cover sides at electrical conduits and other embedded items.
 - 6. Lay vapor retarder directly below slab per ASTM E1643 and manufacturer's written instructions for interior slabs on grade. Lap joints 6" minimum and seal. Provide boots and seal at all penetrations. Adhere to perimeter walls. Repair damaged vapor barrier prior to placing slab on grade.

3.3 CONCRETE MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Use cooled or heated water in accordance with ACI 306.1 and ACI 305.1.
- C. Air-entraining and chemical admixtures, if approved, shall be charged into mixer as a solution and dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighted or measured by volume as recommended by the manufacturer. Superplasticizer may be added at the job site to maintain slump.
- D. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence. Admixtures used in combination shall retain full efficiency and have no deleterious effect on concrete or on properties of each other.
- E. Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Schedule and dispatch trucks from the batching point so that they shall arrive at the site of the work just before the concrete is required to avoid excessive mixing of concrete while waiting.

- F. Discharge at the site shall begin within one (1) hour after charging. Concrete may be used as long as it is of such slump that it can be placed and properly consolidated without the addition of water to the batch (other than water added prior to the start of discharge as given below). If elapsed time since batching exceeds 90 minutes, or if drum has revolved more than 300 revolutions since batching, test air content, slump, and temperature for conformance to this specification prior to placing. In no case shall the time between batching and complete discharge exceed 120 minutes. Do not permit retempering of concrete. Discard concrete that has obtained its initial set.
- G. Do not add water after the initial introduction of the mixing water for the batch, except at the start of discharge, subject to the conditions below. In this case, the producer may add water in an amount not exceeding that allowed to achieve the design water/cement ratio. The drum blades shall then be turned an additional 30 revolutions minimum at mixing speed. Water shall not be added to the batch at any later time. Reject concrete if water is added and these conditions are not met.
 - 1. The measured slump of the concrete is less than that specified in the mix design.
 - 2. No more than 60 minutes have elapsed from the time of batching.
 - 3. The ready-mix plant is notified and approves.
 - 4. Truck tickets indicate maximum amount of water to be added.
 - 5. Water is added in a manner to control volume.
 - 6. Special Inspector is notified, if concrete placement requires inspection.
- H. Maximum concrete temperature delivered to Project site shall be 85°F.
- I. To use materials other than those accepted originally, or if the materials from the source originally accepted change in characteristics, make additional tests with proposed new materials that will verify production of concrete meeting with the stated requirements without causing objectionable change in the color or appearance of the structure. Pay the testing agency for these additional tests. Do not use concrete made from such different materials until the Architect has given his approval.
- J. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished by the Vendor, the Architect may order such changes in the proportions or materials, or both, as may be necessary to secure the desired properties, subject to the stated requirements. Make any changes so ordered without extra compensation.

3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI SPEC-301. Follow recommended practice of ACI PRC-304.
- B. Place concrete for floor slabs following recommended practices of ACI PRC-302.1.
- C. Do not place in rain, sleet or snow unless exposed concrete surface is protected from moisture.
- D. Ensure reinforcement, inserts, and embedded parts will not be disturbed during concrete placement.
- E. If, for any reason, the concrete pour is delayed for more than 45 minutes, bulkhead pour at last acceptable construction joint. Immediately remove excess concrete and clean all forms and in situ concrete surfaces.
- F. Do not permit concrete to drop more than 4 feet from its point of release to mixers, hoppers, or conveyances. Use tremmies, chutes, or pumps as necessary to place columns and walls.
- G. Deposit concrete in wall forms in layers not greater than 24 inches in depth. Consolidate each layer before the succeeding layer is placed.
- H. Place concrete as near as possible to its final position to prevent segregation. Do not use vibrators to transport concrete.

- I. Do not interrupt successive placement; do not permit cold joints to occur.
- J. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- K. Immediately remove concrete spilled on existing surfaces.
- L. Concrete at tops of forms: Strike concrete at top of wall, footing, and pier forms. Smooth and float to texture comparable to adjacent formed surfaces.

3.5 JOINTS

- A. Vertical construction joints in walls shall be a maximum of 80 feet on center and shall be located as shown on structural drawings. If locations are not shown, locate joints at edges of piers integral with wall and near corners and in concealed locations where possible.
- B. Locate construction joints for beams, slabs, joists and girders in the middle 1/3 of the span. Place so they do not compromise the strength of the structure. Offset joints in a girder at least twice the beam width from a beam-girder intersection.
- C. Horizontal joints in walls and columns shall be at underside of slabs, beams and girders and at top of footings. At least 24 hours shall elapse between placing concrete in a wall or column and placing concrete in an area supported by the wall or column.
- D. Reinforcing shall be continuous across construction joints. Provide dowels where detailed or requested. Joints in walls shall be keyed with longitudinal keys at least 1-1/2 inches deep unless detailed otherwise.

3.6 SLAB JOINTING

- A. Locate slab on grade construction and control joints as given on Drawings and submit drawings showing proposed locations. Cut joints as soon as concrete has hardened sufficiently to prevent aggregate dislodgement. Use a "Soff Cut" saw to cut to a depth indicated immediately after final finishing. Use a conventional saw to cut to a depth of one-fourth the slab thickness or as shown on the drawings. Complete sawing within 12 hours of placement.
- 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.

3.7 CONSOLIDATION

- A. Consolidation of concrete shall conform to ACI SPEC-301, unless modified herein.
- B. Follow recommended practices of ACI 309R, unless modified herein.
- C. Consolidate concrete using internal vibrators.
- D. Maintain a spare vibrator at the Project Site during all placing operations.
- E. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material by sandblasting or shotblasting. Broom and vacuum clean. After cleaning, blow surface with oil-free compressed air.
- F. Apply sand and cement slurry coat on base course, immediately prior to placing toppings. Do not allow to dry out prior to casting the topping slab.
- G. Place concrete floor toppings to required lines and levels.

3.8 CONCRETE FINISHING

A. Concrete Finish Schedule

1. Concealed walls, columns, and slabs: Surface finish - 1.0 (SF-1.0).
2. Exposed walls, columns, and wall caps: Surface finish - 2.0 (SF-2.0).
3. Exposed interior concrete floors and floors to receive carpeting: Troweled finish.
4. Exterior slabs: Broom finish.

B. Formed Surfaces

1. Repair surface defects, immediately after removing formwork.
2. Provide finishes per ACI SPEC-301 as scheduled and to the following tolerances.
3. SF-1.0: Surface finish 1.0 per ACI SPEC-301. Rub down or chip off fins or other raised areas 1 inch or more in height. Class C surface tolerance per ACI SPEC-117.
4. SF-2.0: Surface finish 2.0 per ACI SPEC-301. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Class B surface tolerance per ACI SPEC-117.

C. Unformed Surfaces

1. Provide finishes per ACI SPEC-301 as scheduled herein or noted on Drawings and to the following tolerances.
 - a. Troweled Finish: Moderately flat tolerance per ACI SPEC-117. Slope slab to floor drains.
 - b. Broom Finish: Moderately flat tolerance per ACI SPEC-117.
2. Clean exposed concrete to remove laitance, efflorescence and stains.
3. 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.
4. Concrete Polishing: See Section 03 35 11.

3.9 CURING AND PROTECTION

A. Comply with requirements of ACI 308.1 as amended by this section. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

1. Normal concrete: Not less than seven days.
2. At least (4) 6x12-inch or (5) 4x8-inch field cylinders for each pour, prepared and cured according to ASTM C31/C31M alongside the concrete they represent, reach 70% of the specified 28-day strength.
3. The concrete temperature is maintained above 50°F and laboratory cylinders reach 85% of the specified 28-day strength.

B. Formed Surfaces: Cure by moist curing with forms in place for full curing period. If forms are removed during the curing period, cure by one of the methods specified for unformed surfaces.

1. Keep steel forms heated by the sun and all wood forms wet during the curing period.
- C. Unformed Surfaces: Apply curing materials as soon as finishing operations are complete and the concrete's sufficiently hard to be undamaged by the curing process.
1. Waterproof paper or polyethylene film: Use appropriate color of film based on ambient temperature. Sprinkle concrete with water as necessary during application of covering. Lap edges and ends at least 6 inches, and seal laps. Weight down covering to prevent movement. Patch holes and tears that occur during the curing period.
 2. Curing Compounds: Apply strictly according to the manufacturer's instructions using low pressure spray equipment.
 3. Use the following methods:
 - a. Interior surfaces receiving adhesive applied finishes: Cure using wet curing methods or by covering with waterproof paper or polyethylene film.
 - b. Exterior concrete: Cure using exterior concrete curing compound.
 - c. All other unformed surfaces: Cure using a strippable curing compound, by wet curing methods, or by covering with waterproof paper or polyethylene film.
 4. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5° F in any one hour or 50° F in any 24 hour period.

3.10 HOT WEATHER CONCRETING

- A. Apply recommended practices of ACI PRC-305 when wind, temperature and humidity conditions cause evaporation rates (using Figure 2.1.5 of ACI PRC-305) exceeding the following:
1. 0.2 lb/sq ft/hr for concrete with Portland cement only.
 2. 0.1 lb/sq ft/hr for concrete with Portland cement and fly ash.
 3. 0.05 lb/sq ft/hr for concrete with Portland cement and silica fume.
- B. Determine and document expected evaporation rate for the duration of concrete pour.
- C. Wet or fog forms and reinforcing immediately prior to placement to bring temperature to ambient conditions.
- D. Maintain surface moisture during the period immediately after placement and before final finishing by using wind breaks, fog sprayers, evaporation retarders, or shade (individually or in combination) to prevent plastic shrinkage cracking.
1. Use evaporation retarders according to manufacturer's instructions. Do not use as a finishing aid.

3.11 COLD WEATHER CONCRETING

- A. Concrete placed during cold weather shall conform to the requirements of ACI 306.1.
- B. Cold weather is defined as 3 or more successive days when the average daily outdoor temperature is less than 40°F.

- C. All surfaces, including subgrade and reinforcing larger than a #8 bar shall be above 35°F prior to placing concrete. All reinforcing bars #8 and smaller shall be above 10°F prior to placing concrete. Surfaces shall not be more than 10° warmer than the minimum concrete temperatures required by ACI 306.1.
- D. Maintain cold weather protection for the following duration but not less than the duration specified in "Curing and Protection" above:
 - 1. Maintain protection for a minimum of 48 hours after placement of concrete.
 - 2. Maintain protection for columns and supported slabs until at least 4 field cylinders, prepared and cured in accordance with ASTM C31/C31M, reach 85 percent of the specified 28-day strength, or, laboratory cured cylinders reach the specified 28-day strength.
- E. Submit detailed procedures for cold weather concreting for engineer's information only.
- F. Follow recommended practices of ACI PRC-306. Subject to other requirements of this section, a nonchloride accelerator may be used to normalize initial set and for early strength gain.

3.12 FIELD QUALITY CONTROL

- A. Provide free access to concrete operations at project site and cooperate with appointed firm.
- B. Structural Testing and Special Inspection
 - 1. Structural Testing and Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provisions of Section 01 45 33.
 - 2. Personnel Qualifications
 - a. Testing Technician: Technical I - ACI Certified Concrete Field Testing Technician, Grade I, employed by a testing laboratory with C.C.R.L. certification at the National Bureau of Standards, under the direct supervision of a licensed civil/structural engineer. The licensed engineer shall review and approve all reports.
 - b. Special Inspector – Structural I: ICC Certified Concrete Inspector, ACI Concrete Construction Inspector, or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 45 33. The licensed engineer shall review and approve all inspection reports.
 - 3. The Owner will provide the following tests and inspections:
 - a. Tests for cast in place concrete. Qualifications: Technical I.
 - 1) Compression test specimens: ASTM C31/C31M. One set of four 6x12-inch standard cylinders or five 4x8-inch cylinders of concrete for each compressive strength test. Mold and store cylinders for laboratory cured specimens.
 - 2) Compressive strength tests: ASTM C39/C39M . Minimum one strength test for each day's pour, or one strength test for each 150 cubic yards placed. For slabs and walls, no less than one strength test for every 5,000 square feet. A strength test shall be defined as one set of five cylinders, subdivided as follows: One specimen tested at 7 days for information, three at 28 days for acceptance, and one specimen retained in reserve for later testing if required. When frequency of testing will provide less than five strength tests for a given class of concrete, conduct at least five strength tests from randomly

selected batches. If fewer than five batches are used, conduct one test from each batch. A class of concrete is defined as an individual concrete mix design. A batch of concrete is defined as an individual proportion of concrete used in construction (e.g., a single truck load).

- 3) Slump: ASTM C143/C143M. One test at point of discharge for each set of compression test specimens; additional tests when concrete consistency appears to have changed.
- 4) Air entrainment: ASTM C231/C231M, or ASTM C173/C173M where C231 cannot be used. Test the first batch of air entrained concrete and one additional test for each set of compression test specimens.
- 5) Concrete temperature: ASTM C1064/1064M. Test hourly when air temperature is below 40°F or above 80°F and each time a set of compression test specimens is made.

b. Concrete mix verification. Qualifications: Technical I. Verify the following:

- 1) Mixer truck trip ticket conforms to approved mix design.
- 2) Total water added to mix on site does not exceed that allowed by concrete mix design.
- 3) Concrete quality is indicative of adequate mixing time, consistency, and relevant time limits.

c. Observe preparation for and placement of all concrete, excluding slabs on grade, strip footings without transverse reinforcement, and isolated spread footings. Additional exclusions may be noted on the structural drawings. Special Inspector must be present during entire concrete pour. Qualifications: Structural I. Verify the following:

- 1) Acceptable general condition of concrete base prior to placement.
- 2) Concrete conveyance and depositing avoids segregation and contamination.
- 3) Concrete is properly consolidated.
- 4) Reinforcement remains at proper location.

d. Observe protection and curing methods for all concrete, excluding slabs on grade, strip footings without transverse reinforcement, and isolated spread footings. Additional exclusions may be noted on the structural drawings. Observations to be made periodically during the curing period. Qualifications: Structural I. Verify the following:

- 1) Specified curing procedures are followed.
- 2) Specified hot and cold weather procedures are followed.

e. Observe all bolts, rods and structural steel embeds installed in concrete.

Qualifications: Structural I. Verify the following:

- 1) Specified size, type, spacing, configuration, embedment, and quantity.
- 2) Proper concrete placement and consolidation around all bolts, rods and structural steel embeds.

C. Contractor Requirements:

- 1) Provide services of an independent laboratory to perform the following:

- a. Make and test additional cylinders to determine time for form removal.
 - b. Make and test additional cylinders to determine termination of curing procedures.
 - c. Make and test additional cylinders to determine termination of cold weather practices.
- 2) Provide the services of a qualified technical representative to instruct the construction team in proper batching, mixing, placement, and finishing of fiber reinforced concrete.

3.13 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. Acceptance criteria for concrete strength tests shall be as outlined in section 26.12 of ACI 318. If concrete does not meet acceptance criteria, investigation generally following the provisions of section 26.12.4 of ACI 318 will be used at the discretion of the Structural Engineer of Record. Contractor shall reimburse Owner for all costs associated with this investigation. If, in the judgment of the Structural Engineer of Record, the structural adequacy cannot be shown by this investigation, the Contractor shall remove and replace the concrete in question.

3.14 CLEAN-UP

- A. Perform concrete washout only in designated area as required by either Division 31 section Erosion Control or the project NPDES permit.

END OF SECTION

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Structural steel framing members.
- B. Base plates, headed studs, and deformed bar anchors.

1.3 RELATED REQUIREMENTS

- A. Section 01 45 33 - Structural Testing and Special Inspection.
- B. Section 03 15 10 - Post-Installed Anchors.
- C. Section 03 10 00 - Concrete Forming and Accessories: Anchor rods and structural steel to be embedded in concrete affecting structural steel work.
- D. Section 04 29 00 - Structural Unit Masonry

1.4 REFERENCE STANDARDS

- A. AISC MANUAL - Steel Construction Manual; 2017, 15th Edition.
 - 1. AISC 360 - Specification for Structural Steel Buildings; 2016.
 - 2. RCSC - Specification for Structural Joints Using High-Strength Bolts; 2014.
 - 3. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- D. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- G. ASTM A496 - Steel Wire, Deformed, for Concrete Reinforcement; 2002.
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- I. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- J. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

- L. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series; 2017a.
- M. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- N. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2013.

- O. ASTM F1852 - Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2008.
- P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- S. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.5 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Shop Drawings:
 - 1. Review the Contract Documents prior to preparing shop drawings to determine if the structure is in conflict with OSHA requirements or any other safety regulation. Notify the Architect if any conflicts are noted. Do not prepare shop drawings affected by the conflict until the conflict is resolved.
 - 2. Prepare complete shop and setting drawings based on referenced AISC Specifications.
 - 3. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 4. Indicate type and location of shop and field connections. Detail all required field welds.
 - 5. Indicate cambers.
 - 6. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
 - 7. If shop drawings are resubmitted after the original review, identify all changes made to the shop drawings after the original submittal with clouds or similar markings.
- C. Submit AISC Quality Certification Program certificates (for reduction in shop special inspections only if the fabricator is so certified) and welder qualifications to the Special Inspector-Technical.
- D. Welders' Qualification Statement: Submit to Special Inspector welders' qualifications in accordance with AWS B2.1/B2.1M.

1.6 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC "Manual of Steel Construction".
- B. Implement the quality control and quality assurance provisions of Chapter N of AISC 360. Document is available at www.aisc.org/publications/steel-standards/.
- C. Fabrication plant shall be certified in Buildings according to the requirements of the AISC Quality Certification Program and shall be acceptable to the structural engineer, Architect, and building official.

1. A fabricator without AISC certification may be acceptable subject to the following.
 - a. The fabrication plant shall be acceptable to the Structural Engineer, Architect, and Building Official.
 - b. The fabrication plant shall maintain written, detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and for the fabricator's ability to conform to the construction documents.
 - c. The Contractor shall reimburse Owner for required quality assurance inspections during steel fabrication. This inspection shall be conducted by the Owner's inspection company at the fabrication plant.
- D. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located. E. Codes and Standards:
 1. AISC MANUAL - Manual of Steel Construction.
 2. AISC 360 - Specification for Structural Steel Buildings
 3. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges
 4. AWS D1.1/D1.1M.
 5. RCSC - Specification for Structural Joints Using High-Strength Bolts
 6. SSPC - SSPC Painting Manual - Volume 2
- F. Provide personnel qualified according to AWS D1.1/D1.1M for all shop and field welding.

1.7 PROJECT/SITE CONDITIONS

- A. Verify all dimensions given on the Drawings and make such field measurements as are necessary to lay out the work properly and assure proper elevations. Be fully responsible for accuracy of all measurements and laying out of the work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
 1. The longitudinal butt joint of welded tubing shall be welded across its full thickness.
- D. Pipe: ASTM A53/A53M, Grade B, Finish black.
- E. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars per AWS D1.1/D1.1M.
- F. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A.
- G. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, medium carbon, plain.
 1. Tension control bolts meeting ASTM F1852 are also acceptable.

- H. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers. Hot dip galvanize where noted.
- I. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at all connections requiring high-strength bolts. Not required if tension control bolts are used.
- J. Welding Materials: AISC Specification A35 and referenced AWS specifications, type required for materials being welded, E70 electrodes.
- K. Shop and Touch-Up Primer: Fabricator's standard, compatible with finish coatings, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- M. Post-installed anchors: See Section 03 15 10 - Post-Installed Anchors.
- N. Deformed Bar Anchors: ASTM A496, AWS D1.1, Chapter 7, arc stud welded.

2.2 FABRICATION

- A. Fabricate according to referenced AISC publications.
- B. Shop fabricate to greatest extent possible.
- C. Do not substitute sections or modify details without written approval of the Structural Engineer. Provide full-length pieces between connections or splices indicated on the drawings. Do not permit built-up lengths. Do not use warped or damaged sections.
- D. Design shop and field connections unless detailed on the Drawings. Use standard connections as shown in Part 9 of the AISC Manual where possible. Bolt field connections, unless otherwise indicated on the Drawings.
- E. Perform bracing, blocking, cutting, fitting, drilling, tapping, welding, punching, etc., as required to complete work and to join work of others. Weld clip angles and plates to beams and punch holes for fastening work of other trades as shown on the Drawings.
- F. Furnish anchor bolts of size and type shown on the drawings for all field connections to be permanently bolted to concrete or masonry.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 3 unless otherwise indicated.
- B. Shop prime structural steel members to a DFT of 2.0 - 3.5 mils. Do not prime surfaces that will be fireproofed or field welded.
- C. Galvanize structural steel exposed to weather, lintels in exterior masonry walls, and shelf angles and plates in exterior masonry walls to comply with ASTM A123/A123M
 - 1. Prepare items to be galvanized in accordance with ASTM A385.
 - 2. Close and seal weld vent holes in pipes, tubes, and other closed members. Touch up damaged areas using procedures and products from ASTM A780/A780M .

2.4 SOURCE QUALITY CONTROL

- A. Perform quality control procedures and inspections as outlined in Chapter N of AISC 360.
- B. Implement quality assurance provisions as outlined in Chapter N of AISC 360.

1. If Fabricator holds an AISC Building certification, quality assurance procedures and inspections may be performed by the Fabricator. If Fabricator does not hold an AISC Building certification, Owner will provide quality assurance procedures and inspections as outlined in Part 1.

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. Exercise care in handling structural steel during unloading, storage, and erection to prevent bends, twists, or other damage.
- D. Place structural steel stored at the site on substantial shores or blocking. Provide shores or blocking of sufficient size and strength to prevent any part of the steel from touching the ground.
- E. Remove dirt, oil, loose scale, burrs, pits, paint and other defects that would prevent solid seating of parts.
- F. Field weld components indicated on shop drawings.
- G. Where A307 bolts are used, tighten to a snug tight fit as obtained with the full effort of a man using an ordinary spud wrench. Verify that all parts are in contact. Use self-locking nuts or upset bolt threads to prevent nuts from bracing off.
- H. Where A325 bolts are used, tighten bolts and provide washers in accordance with "Specification for Structural Joints Using High Strength Bolts". Use tension control bolts or direct tension indicators for slip-critical (SC) and fully tensioned bolts (FT).
- I. Pre-heat material to be welded and maintain interpass temperatures as required. Do not weld below 0 degrees F.
- J. Remove all ceramic welding ferrules from shear studs.
- K. Do not cut steel or enlarge holes without written approval of the Structural Engineer.
- L. Do not field cut or alter structural members without approval of Architect and Structural Engineer.
- M. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete or specified to be unprimed.
- N. Repair or replace structural steel damaged during shipment, unloading, or erection at no cost to the Owner.
- O. Install expansion and adhesive anchors in strict accordance with manufacturer's recommendations.

3.3 CLEANING AND REPAIR

- A. After erection and welding of steel, remove clay, mud or other foreign materials from all members.
- B. Apply a field touch-up coat of paint on all welded connections and damaged areas using the same color and type of paint used on the shop coat.

- C. Repair damaged galvanized members with procedures and products from ASTM A780/A780M . **3.4**

FIELD QUALITY CONTROL

- A. Perform erection quality control procedures and inspections as outlined in AISC 360 Chapter N.
- B. Owner will provide erection quality assurance provisions as outlined in AISC 360 Chapter N.

END OF SECTION

SECTION 05 3100 - STEEL DECKING

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Roof deck.
- B. Floor Decking

1.3 RELATED REQUIREMENTS

- A. Section 01 45 33 - Structural Testing and Special Inspection
- B. Section 03 30 00 – Cast-In-Place Concrete
- C. Section 05 12 00 - Structural Steel Framing: Support framing for openings larger the 6 inches.

1.4 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron AlloyCoated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, HighStrength 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 D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- F. SDI (RD) - Specifications and Commentary for Steel Roof Deck; 2017 G. SDI (C) – Specifications and Commentary for Composite Deck; 2017
- H. SDI (NC) – Specifications and Commentary for Non-Composite Deck; 2017
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- J. SSPC-Paint 20 – Zinc-Rich Primers (Type 1 – Inorganic and Type II – Organic)

1.5 SUBMITTALS

- A. See Division 1 for submittals 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.
 - 1. If shop drawings are resubmitted after the original review, identify all changes made to the shop drawings after the original submittal with clouds or similar markings.

- D. Welders' Qualification Statement: Submit to Special Inspector welders' qualifications in accordance with AWS B2.1/B2.1M.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years of experience.
- B. Codes and Standards: Comply with the provisions of the following, except as otherwise indicated:
 - 1. SDI (RD), "Specifications and Commentary for Steel Roof Deck"
 - 2. SDI (C) – Specifications and Commentary for Composite Deck; 2017
 - 3. SDI (NC) – Specifications and Commentary for Non-Composite Deck; 2017
 - 4. AWS D1.3, "Structural Welding Code - Sheet Steel"
- C. Provide personnel qualified according to AWS D1.3 for all shop and field welding.
- D. Manufacturer shall be a member of the Steel Deck Institute.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Store deck on dry wood sleepers; slope for positive drainage. Protect with a waterproof covering ventilated to avoid condensation.
- C. Deliver, unload, store and erect deck in a manner to completely protect the deck from damage.

1.8 PROJECT SITE CONDITIONS

- A. Verify all dimensions given on the Drawings and make such field measurements as are necessary to lay out the work properly and assure proper fit and proper elevations. Be fully responsible for accuracy of all measurements and laying out of the work.

PART 2 PRODUCTS

2.1 STEEL DECK

- A. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 40, Type 1.
 - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
 - a. Deck to be fireproofed: Left unpainted on the side to be fireproofed or painted with a primer compatible with the fireproofing to achieve the required UL rating. B. Floor Deck: Composite/Non Composite type, fluted steel sheet:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Grade 33 Structural Quality with G30 galvanized coating conformitng to ASTM A924/924M.

2.2 ACCESSORY MATERIALS

- A. Welding Materials: AWS D1.1 and D1.3, E70xx electrodes.
- B. Power Driven Fasteners: Hilti X-HSN24 for bar joists 1/8" to 3/8" thick, X-ENP for structural steel greater than 1/4" thick.
- C. Screw Fasteners: Galvanized hardened steel, self tapping, TEKS.
- D. Shop and Touch-Up Primed Surfaces: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- E. Shop and Touch-Up for Galvanized Surfaces: SSPC-Paint 20, Type I – Inorganic complying with VOC limitations of authorities having jurisdiction.
- F.

2.3 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

2.4 FABRICATION

- A. Fabricate in accordance with SDI Specifications.
- B. Fabricate deck to span over a minimum of 3 supports wherever possible.

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 Specifications and manufacturer's instructions. Align and level.
- B. On steel supports provide minimum 1-1/2 inch bearing, unless otherwise shown on Drawings.
- C. On concrete or masonry support surfaces provide minimum 4" bearing, unless otherwise shown on Drawings.
- D. Fasten deck in accordance with deck fastening detail shown on drawings or manufacturer's standard requirements, whichever is greater.
- E. Weld deck in accordance with AWS D1.3. Do not weld when temperature is below 0 degrees F. Protect metal being welded from rain and snow.
- F. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.
- G. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- H. Install wet concrete stops at floor edge upturned to top surface of slab, to contain wet concrete. Install stops of sufficient strength to remain stationary without distortion.
- I. Immediately after welding deck and other metal components in position, clean welds and coat welds, burned areas, and damaged surface coating, with touch-up primer after inspections are completed. J. Install deck with major flat surface on top (normal position).

- K. Protect the completed deck from construction loads in excess of 30 psf. Move all loads across the deck on wood planking (or similar means) to distribute loads.

3.3 FIELD QUALITY CONTROL

- A. Establish lines, levels, and coursing indicated. Protect from displacement. Structural Testing and Special Inspection
 - 1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 45 33.
 - 2. Definitions:
 - a. ASNT - American Society for Non-Destructive Testing
 - b. CAWI - American Welding Society Certified Associate Weld Inspector
 - c. CWI - American Welding Society Certified Weld Inspector
 - 3. Personnel Qualifications
 - a. Special Inspector Technical II: CAWI with minimum 3 years experience or ASNT Level II, employed by a testing agency and supervised by a CWI or ASNT Level III with a minimum of 10 years experience.
 - b. Individuals performing welding inspection must be AWS certified.
 - 4. The Owner will provide the following tests and inspections. Qualifications: Technical II
 - a. Verify qualifications of welders prior to the start of welding.
 - b. Observe welding procedures at the start of welding. Verify that appropriate welds are being obtained.
 - c. Verify quality, size, location, and spacing of all welds and mechanical fasteners.

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural composite lumber framing.
- B. Sheathing.
- C. Preservative treated wood materials.
- D. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
- B. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products; 2021, with Editorial Revision.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
- E. PS 1 - Structural Plywood; 2023.
- F. PS 2 - Performance Standard for Wood Structural Panels; 2019.
- G. PS 20 - American Softwood Lumber Standard; 2025.
- H. SPIB (GR) - Grading Rules; 2014.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Wood sourced from a sustainably harvested location. Submit any documentation available.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring (WD BLKG):
 - 1. Lumber: S4S, No. 2 or Standard Grade.

2. Boards: Standard or No. 3.

2.03 STRUCTURAL COMPOSITE LUMBER

- A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.
- B. Structural Composite Lumber Materials: Factory-fabricated engineered wood products consisting of wood veneers, strands, or flakes pressed with moisture-resistant adhesive into blocks of material, evaluated in accordance with ASTM D5456.
 1. Laminated Veneer Lumber (LVL): Engineered wood products consisting of thin wood veneer bonded together with adhesive with grain of veneers running parallel to long dimension.
 - a. Manufacturer's Published Modulus of Elasticity, E: 1,800,000 psi (12,410 MPa), minimum.
 2. Parallel Strand Lumber (PSL): Engineered wood products consisting of long wood strands bonded together with adhesive with grain running parallel to long dimension.
 - a. Strand Length-to-Thickness Ratio: Approximately 300.
 - b. Manufacturer's Published Modulus of Elasticity, E: 1,800,000 psi (12,410 MPa), minimum.
 3. Laminated Strand Lumber (LSL): Engineered wood products consisting of flaked wood strands bonded together with adhesive.
 - a. Strand Length-to-Thickness Ratio: Approximately 150.
 - b. Manufacturer's Published Modulus of Elasticity, E: 1,800,000 psi (12,410 MPa), minimum.
 4. Oriented Strand Lumber (OSL): Engineered wood product consisting of flaked wood strands bonded together with adhesive.
 - a. Strand Length-to-Thickness Ratio: Approximately 75.
 - b. Manufacturer's Published Modulus of Elasticity, E: 1,800,000 psi (12,410 MPa), minimum.

2.04 CONSTRUCTION PANELS

- A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
 1. (WD SHTG-32): 3/4 inch.
- B. Other Applications:
 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Sill Gasket on Top of Foundation Wall: 3/8 inch (9.5 mm) thick, closed-cell plastic foam.
 1. Width: 3-1/2 inches (89 mm).
 2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
- C. Sill Flashing: See Section 07 6200.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
 1. Products:
 - a. Lonza Group: www.wolmanizedwood.com.
 - b. Koppers Performance Chemicals, Inc: www.koppersperformancechemicals.com.
 - c. Viance, LLC: www.treatedwood.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 4. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A.
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension in the most efficient direction to wall studs, with ends over firm bearing and staggered, using nails or screws.

3.05 CLEANING

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.

1.02 RELATED REQUIREMENTS

- A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet substrate and finish.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Wood Veneer Faced Cabinet:
 - 1. Exposed Surfaces: HPVA HP-1 Grade B, Maple, plain sliced, book-matched.
 - 2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Maple, plain sliced, book-matched.
 - 3. Concealed Surfaces: Manufacturer's option.
- C. Cabinets (PLAM-#):
 - 1. Basis of Design: See drawings for product information.
 - 2. Finish - Exposed Exterior Surfaces: Decorative laminate.

3. Finish - Exposed Interior Surfaces: Decorative laminate.
4. Finish - Semi-Exposed Surfaces: Decorative laminate
5. Finish - Concealed Surfaces: Manufacturer's option.
6. Door and Drawer Front Edge Profiles: Square edge with thick applied band.
7. Casework Construction Type: Type A - Frameless.
8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
9. Layout for Cabinet and Door Fronts: Flush panel.
10. Adjustable Shelf Loading: 40 psf (19.5 gm/sq cm).
 - a. Deflection: L/144.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.
- B. Wood sourced from a sustainably harvested location. Submit any documentation available.
- C. Provide composite wood containing no added formaldehyde. See Section 01 6116.

2.03 PANEL CORE MATERIALS

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
 1. Grade: M-2; moisture resistance: MR10.

2.04 THERMALLY FUSED LAMINATE PANELS

- A. Thermally Fused Laminate (TFL): Melamine-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
 1. Panel Core Substrate: Particleboard.

2.05 LAMINATE MATERIALS

- A. Manufacturers:
 1. Formica Corporation: www.formica.com.
 2. Panolam Industries International, Inc: www.panolam.com/#sle.
 3. Wilsonart LLC: www.wilsonart.com/#sle.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as follows:
 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness.
 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness.
 3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness.
 4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

- A. Countertops: See Section 12 3600.

2.07 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded 3 mm PVC, flat shaped; smooth finish; of width to match component thickness.
 1. Color: As selected by Architect from manufacturer's standard range.

- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.
 - 1. Provide one grommet for every 5 linear feet of countertop (excluding toilet rooms), unless noted otherwise. Coordinate locations with Architect/Owner.

2.08 HARDWARE

- A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
 - 1. Hardware Types: As indicated on drawings.
 - 2. Product Grade: As required by specified woodworking quality grade.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).
- D. Drawer Slides:
 - 1. Type: Full extension with overtravel.
 - 2. Static Load Capacity: Heavy Duty grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
 - 6. Manufacturers:
 - a. Accuride International, Inc: www.accuride.com.
 - b. Grass America Inc: www.grassusa.com.
 - c. Hettich America, LP: www.hettich.com.
 - d. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- E. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
 - 1. Manufacturers:
 - a. Blum, Inc: www.blum.com/#sle.
 - b. Grass America Inc: www.grassusa.com/#sle.
 - c. Hardware Resources: www.hardwareresources.com.
 - d. Hettich America, LP: www.hettich.com/sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.09 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

- D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 8100 - APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applied fire protection of interior structural steel not exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing.
- B. Section 07 8400 - Firestopping.
- C. Section 09 2116 - Gypsum Board Assemblies: Gypsum board fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).
- C. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- D. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.
- E. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics.
- C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
 - 1. Bond strength.
 - 2. Bond impact.
 - 3. Compressive strength.
 - 4. Fire tests using substrate materials similar those on project.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience

1.07 FIELD CONDITIONS

- A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F (4 degrees C) or when temperature is predicted to be below said temperature for 24 hours after application.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Applied Fire Protection:
 - 1. GCP Applied Technologies: www.gcpat.com.
 - 2. Isolatek International Corp: www.isolatek.com.
 - 3. Southwest Fireproofing Products Company: www.sfrm.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLIED FIRE PROTECTION ASSEMBLIES

- A. Provide assemblies as indicated on drawings.

2.03 MATERIALS

- A. Applied Fire Protection Material (FR PRF-10): Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
 - 1. Composition: Gypsum-based; not mineral-fiber-based.
 - 2. Bond Strength: 150 pounds per square foot (7.2 kPa), minimum, when tested in accordance with ASTM E736/E736M when set and dry.
 - 3. Dry Density: As required by fire resistance design.
 - 4. Compressive Strength: 8.33 pounds per square inch (57.4 kPa), minimum.
 - 5. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
 - 6. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
 - 7. Air Erosion Resistance: Weight loss of 0.025 g/sq ft (0.27 g/sq m), maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
 - 8. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
 - 9. Basis of Design Products:
 - a. GCP Applied Technologies; Monokote MK-10 HB: www.gcpat.com.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing. Repair existing fireproofing using same method as original installation or trowel installation techniques recommended by manufacturer.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled.
- E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

- A. Apply primer adhesive in accordance with manufacturer's instructions.
- B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.
- B. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
- C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).
- D. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.
- D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus; 2025.
- E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a, with Editorial Revision (2024).
- F. ITS (DIR) - Directory of Listed Products; current edition.
- G. FM (AG) - FM Approval Guide; Current Edition.
- H. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- J. UL (DIR) - Online Certifications Directory; Current Edition.
- K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Certificate from authority having jurisdiction indicating approval of materials used.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Verification of minimum three years documented experience installing work of this type.
- D. Firestop sealants upon curing, shall not re-emulsify, dissolve, leach, breakdown or otherwise be damaged over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic in a building's normal operating life.
- E. Firestop sealants selected shall be sufficiently flexible to accommodate motion such as pipe vibration, water-hammer, thermal expansion, and other normal building movement, without damage to the seal.
- F. One manufacturer shall supply all firestopping material to the extent possible.
- G. All firestop materials shall be installed prior to expiration of shelf life.

1.05 COORDINATION

- A. Schedule firestopping after installation of penetrants, but prior to concealing the openings.
- B. Firestopping shall precede gypsum board finishing.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com.
 - 3. Hilti, Inc: www.us.hilti.com.
 - 4. Nelson FireStop Products: www.nelsonfirestop.com.
 - 5. Specified Technologies Inc: www.stifirestop.com.
 - 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping (FR STOP): Any material meeting requirements.
 - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

- A. General: Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such materials designated as insulation, safing, or otherwise.
- B. Through-Penetration: Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.
- C. Membrane-Penetration: Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.
- D. Construction Joints/Gaps: Firestopping shall be provided at all fire rated walls as indicated on project drawings.
 - 1. Between the tops of walls and the underside of floors.
 - 2. In expansion joints at fire rated walls.
 - 3. In any penetration through fire rated wall, fill gaps and spaces with fire stopping material sufficient to maintain intended wall rating.
 - 4. Smoke-Stopping: As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.03 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.04 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.05 MARKING AND IDENTIFICATION

- A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
 - 1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
 - 2. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition; and
 - 3. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording. "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS" or other wording.

3.06 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- B. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015e1.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
- B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.

4. Deliver sufficient samples to manufacturer for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 1. Bostik Inc: www.bostik-us.com.
 2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
 3. Hilti, Inc: www.us.hilti.com.
 4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 5. Pecora Corporation: www.pecora.com.
 6. Sherwin-Williams Company: www.sherwin-williams.com.
 7. Sika Corporation: www.usa-sika.com.
 8. Specified Technologies Inc: www.stifirestop.com.
 9. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 10. W.R. Meadows, Inc: www.wrmeadows.com.
 11. Substitutions: See Section 01 6000 - Product Requirements.
- B. Self-Leveling Sealants:
 1. Bostik Inc: www.bostik-us.com.
 2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
 3. Pecora Corporation: www.pecora.com.
 4. Sherwin-Williams Company: www.sherwin-williams.com.
 5. Sika Corporation: www.usa-sika.com.
 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 7. W.R. Meadows, Inc: www.wrmeadows.com.
 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 1. Exterior Joints:
 - a. Do not seal exterior joints unless indicated on drawings as sealed.
 - b. Seal open joints except open joints indicated on drawings as not sealed.
 2. Interior Joints:
 - a. Do not seal interior joints indicated on drawings as not sealed.
 - b. Do not seal gaps and openings in gypsum board and suspended ceilings
 - c. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
 - d. Seal open joints except specific open joints indicated on drawings as not sealed.
 3. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be covered with expansion joint cover assemblies.
 - c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
 - d. Joints where sealant installation is specified in other sections.
 - e. Joints between suspended ceilings and walls.

- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 - 2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 - 3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 - 4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
 - 5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
 - 6. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

- A. Material ID's:
 - 1. (SEALANT-1): Joint sealant or caulking with or without backer rod. Type as indicated above.

2.04 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Cure Type: Multi-component, neutral curing.
 - 3. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
- B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, non-sagging; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

2.05 SELF-LEVELING JOINT SEALANTS

- A. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - 1. Composition: Multicomponent, 100 percent solids by weight.
 - 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 - 3. Color: To be selected by Architect from manufacturer's standard colors.
 - 4. Joint Width, Minimum: 1/8 inch (3 mm).
 - 5. Joint Width, Maximum: 1/4 inch (6 mm).
 - 6. Joint Depth: Provide product suitable for joints from 1/8 inch (3 mm) to 2 inches (51 mm) in depth including space for backer rod.

2.06 ACCESSORIES

- A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 08 1213 - HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal frames for non-hollow metal doors.
- B. Fire-rated hollow metal frames for non-hollow metal doors.
- C. Interior glazed borrowed lite frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Hardware and weatherstripping.
- B. Section 08 8000 - Glazing: Glazed borrowed lites.
- C. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- F. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- H. 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; 2017.
- I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- J. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- M. ITS (DIR) - Directory of Listed Products; current edition.
- N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2018.

- T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- U. UL (DIR) - Online Certifications Directory; Current Edition.
- V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- W. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Samples: Submit one sample of frame metal, 2 by 2 inches (50 by 50 mm), showing factory finishes, colors, and surface textures.
- E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 MANUFACTURERS

- A. Hollow Metal Frames with Integral Casings:
 - 1. Sustainability Requirements: Manufacturers must be able to provide the following, or acceptable alternate, product documentations:
 - a. Living Building Challenge Red List Free or Compliant.
 - b. Declare Label.
 - c. Environmental Product Declaration (EPD).
 - d. Health Product Declaration (HPD).
 - 2. Basis of Design: Steelcraft, an Allegion brand: www.allegion.com.
 - 3. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - b. Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - c. Republic Doors, an Allegion brand: www.republicdoor.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Hollow Metal Frames with Applied Casings, Prefinished:

1. Sustainability Requirements: Manufacturers must be able to provide the following, or acceptable alternate, product documentations:
 - a. Environmental Product Declaration (EPD) or Declare Label.
 - b. Living Building Challenge Red List Free or Compliant.
 - c. Declare Label.
 - d. Environmental Product Declaration (EPD).
 - e. Health Product Declaration (HPD).
2. The Dunbarton Group; Redi-Frame: <http://dunbarton.com>.
3. IDP - International Door Products Corp: www.idpframes.com.
4. Timely Industries, Inc: www.timelyframes.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.03 PERFORMANCE REQUIREMENTS

- A. Refer to Door and Frame Schedule on drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.
- B. Door Frame Type: Provide hollow metal door frames with integral casings.
- C. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- D. Accessibility: Comply with ICC A117.1 and ADA Standards.
- E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
- F. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.
- G. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- H. Zinc Coating for Units Subject to Corrosive Conditions: Components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise.
- I. Frames for Interior Glazing or Borrowed Lites: Construction and face dimensions to match door frames, and as indicated on drawings.
- J. Frames Wider than 48 Inches (1219 mm): Reinforce with steel channel fitted tightly into head of frame, and flush with top.

2.04 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

- A. Interior Door Frames, Non-Fire Rated: Face welded type.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty. (Except Level 3 - Extra Heavy-duty for frames in masonry openings.)
 - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum. (Except 14 gauge, 0.067 inch (1.7 mm) for frames in masonry openings.)
 2. Frame Finish: Factory primed and field finished.
- B. Fire-Rated Door Frames: Face welded type.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty. (Except Level 3 - Extra Heavy-duty for frames in masonry openings.)
 - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum. (Except 14 gauge, 0.067 inch (1.7 mm) for frames in masonry openings.)
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C or NFPA 252 ("positive pressure fire tests").
3. Temperature-Rise Rating (TRR) Across Framed Door Thickness: In accordance with local building code and authorities having jurisdiction.
 - a. Provide units listed and labeled by ITS (DIR) or UL (DIR).
 - b. Attach fire rating label to each fire rated unit.
4. Frame Finish: Factory primed and field finished.

2.05 HOLLOW METAL DOOR FRAMES WITH APPLIED CASINGS

- A. Frame Type: Knockdown, slip-on drywall frames; separate jambs and head with separate snap-on casings both sides; factory-applied finish on exposed surfaces.
 1. Frame Material: Cold-rolled steel complying with ASTM A1008/A1008M.
 2. Casing Material: Formed steel.
 3. Casing Profile: As indicated.
 4. Finish: Factory-applied baked enamel finish, or electrostatically applied water-based paint.
 - a. Color: As selected from manufacturer's full line.
- B. Interior Door Frames, Non-Fire-Rated:
 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
 2. Frames in Wet Areas: Electro-galvanize components prior to finishing in accordance with ASTM A879/A879M, with manufacturer's standard coating thickness.
- C. Interior Door Frames, Fire-Rated: Provide smoke gaskets.
 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
 2. Frames in Wet Areas: Electro-galvanize components prior to finishing in accordance with ASTM A879/A879M, with manufacturer's standard coating thickness.
 3. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C or NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by testing agency acceptable to authorities having jurisdiction, ITS (DIR), or UL (DIR).
 - b. Attach fire rating label to each fire rated unit.
 4. Smoke and Draft Control Doors: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure at both ambient and elevated temperatures; with "S" label; if necessary, provide additional gasketing or edge sealing.

2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.07 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

- B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. Install door hardware as specified in Section 08 7100.
- G. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.5 mm) measured with straight edges, crossed corner to corner.

END OF SECTION

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 6 x 6 inch (152 x 152 mm) in size illustrating wood grain, stain color, and sheen.
- E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD) or Declare Label.
 - b. Health Product Declaration (HPD).
 - 2. Basis of Design: Forte Opening Solutions; Aspiro Select Wood Veneer Doors: www.forteopenings.com.
 - 3. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. Oregon Door; Architectural Series: www.oregondoor.com.
 - b. VT Industries, Inc: www.vtindustries.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Wood veneer facing with factory transparent finish, as indicated on drawings.

2.04 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.05 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer.
 - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.

- B. Provide sustainably harvested wood, sourced or labeled as specified in Section 01 6000.
- C. Provide composite wood containing no added formaldehyde. See Section 01 6116.
- D. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- E. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- F. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- H. Provide edge clearances in accordance with the quality standard specified.

2.07 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 9 UV Curable Acrylated Epoxy Polyester or Urethane.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
- B. Seal door top edge with color sealer to match door facing.

2.08 ACCESSORIES

- A. Glazing: See Section 08 8000.
- B. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.
- C. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 3326 - MESH SECURITY CURTAIN MODIFICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Modification of existing mesh security curtain.
 - 1. Provide new lock channel assembly. All other security curtain components existing to remain.

1.02 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide general construction component connections and details.

PART 2 PRODUCTS

2.01 COILED WIRE FABRIC SYSTEMS

- A. Modify existing curtain assembly for new locking channel.
- B. Basis of Design: V107 and V111 lock channel assembly by Cascade Coil Drapery, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for installation.
- B. Verify that door opening is plumb, header is level, and dimensions are correct.
- C. Notify Architect of any unacceptable conditions or varying dimensions.
- D. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).
- C. Maximum Variation From Level: 1/16 inch (1.5 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

- A. Adjust grille, hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean grille and components.

- B. Remove labels and visible markings.

END OF SECTION

SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- H. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Energy Performance Certification: For each aluminum framed storefront system and glazing combination provide NFRC CMAST Bid Report. Coordinate with Section 08 8000.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

- A. Center-Set Style, Not Thermally-Broken:
 - 1. 2 inch by 4-1/2 inch, nominal frame profile.
 - a. Basis of Design: Kawneer Company, Inc; Trifab VersaGlaze 451; www.kawneer.com.
 - b. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - 1) EFCO Corporation; Series 402; www.efcocorp.com.
 - 2) Oldcastle Building Envelope; FG-3000; obe.com.
 - 3) Tubelite Inc; E14000 Series; www.tubeliteinc.com.
 - 4) YKK AP America Inc; YES 45 FI; www.ykkap.com.

2.03 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Not Thermally-Broken:
 - 1. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD) or Declare Label.

- b. Living Building Challenge Red List Free or Compliant.
- 2. Basis of Design: Kawneer Company, Inc; 500 Heavy Wall Entrances; www.kawneer.com.
- 3. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. EFCO Corporation; Series D518 DuraStile; www.efcocorp.com.
 - b. Oldcastle Building Envelope; Rugged Entrance Wide Stile Door and Frame; obe.com.
 - c. Tubelite Inc; Monumental Doors; www.tubeliteinc.com.
 - d. YKK AP America Inc; 50M Monumental Commercial Entrances; www.ykkap.com.

2.04 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront (ALSTOR-1): Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Rabbet: For 1/4 inch glazing.
 - 2. Finish Color: As selected by Architect.
 - 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 - 6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - 7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Flush.
 - 3. Cross-Section: As indicated on drawings.
 - 4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: See Section 08 8000.
- C. Swing Doors: Glazed aluminum.
 - 1. Top Rail: 5 inches (127 mm) wide, nominal.
 - 2. Vertical Stiles: 5 inches (127 mm) wide, nominal.
 - 3. Bottom Rail: 10 inches (254 mm) wide.
 - 4. Glazing Stops: Square.
 - 5. Finish: Same as storefront.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
- E. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch (0.48 mm) minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.07 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

2.08 HARDWARE

- A. Other Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.
- G. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for general testing and inspection requirements.
- B. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for wood doors.

1.02 RELATED REQUIREMENTS

- A. Section 08 1213 - Hollow Metal Frames.
- B. Section 08 1416 - Flush Wood Doors.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. BHMA - Builders Hardware Manufacturers Association.
- C. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.
- D. DHI (KSN) - Keying Systems and Nomenclature; 2019.
- E. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- F. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- H. ITS (DIR) - Directory of Listed Products; current edition.
- I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- J. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
- L. UL (DIR) - Online Certifications Directory; Current Edition.
- M. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Architect.
 - 2. Installer's Architectural Hardware Consultant (AHC).
 - 3. Hardware Installer.
 - 4. Owner's Security Consultant.
- C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- D. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature".
Submit copies of owner approved key schedule for review and field use in quantities as required by

Division 01 - General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution and field use.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 - a. Submit in vertical format.
 - 3. List groups and suffixes in proper sequence.
 - 4. Provide complete description for each door listed.
 - 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 - 6. Include account of abbreviations and symbols used in schedule.
- D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - 1. Submit manufacturer's parts lists and templates.
 - 2. Bitting List: List of combinations as furnished.
- E. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.
- C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- E. Hardware supplier shall be factory trained and certified by the manufacturer to provide and support all computer managed locks and system components.
- F. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.
- G. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

- H. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
 - 1. Closers: Ten years, minimum.
 - 2. Locksets and Cylinders: Three years, minimum.
 - 3. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Applicable provisions of NFPA 101.
 - 4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
 - 5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
 - 6. Listed and certified compliant with specified standards by BHMA (CPD).
 - 7. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 8. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
 - 9. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
 - 3. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.02 MANUFACTURERS

- A. Provide manufacturers, products, and product lines listed within this Section and as indicated in Section 08 7105 - Hardware Groups.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.03 HINGES

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Butt Hinges
 - a. Standard Weight, Ball Bearing, Non-Ferrous:
 - 1) Ives: 5BB1
 - 2) Stanley: FBB191
 - 3) Hager: BB1191
 - 4) McKinney: TB2314
 - b. Heavy Weight, Ball Bearing:
 - 1) Ives: 5BB1HW
 - 2) Stanley: FBB168
 - 3) Hager: BB1168
 - 4) McKinney: T4B3786
 - c. Heavy Weight, Ball Bearing, Non-Ferrous:
 - 1) Ives: 5BB1HW
 - 2) Stanley: FBB199
 - 3) Hager: BB1199
 - 4) McKinney: T4B3386
- B. Hinges: Comply with BHMA A156.1, Grade 1.
 - 1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 - 2. Provide hinges on every swinging door.
 - 3. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 - 4. Provide non-removable pins on exterior outswinging doors.
 - 5. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
 - 6. Unless otherwise specified, furnish hinges in the following sizes:
 - a. 4-1/2" x 4-1/2" 1-3/4" thick doors
 - 7. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
 - 8. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior and out-swinging interior doors.
 - 9. Unless otherwise specified, furnish all hinges to template standards.
 - 10. Unless otherwise specified, furnish hinge weight and type as follows:
 - a. Standard weight: ball bearing hinge 5BB1 for interior opening 40 inches wide.
 - b. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
 - c. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
 - 11. Provide following quantity of butt hinges for each door:
 - a. Doors up to 60 inches (1.5 m) High: Two hinges.

- b. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.
- c. Doors 90 inches (2.3 m) High up to 120 inches (3 m) High: Four hinges.
- d. Doors over 42 inches wide: One additional hinge.

2.04 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 - 1. Provide full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 - 2. Provide cams and/or tailpieces as required for locking devices.
 - 3. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

2.05 MORTISE LOCKS

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Schlage L9000 Series 17A
 - 2. Sargent 8200 Series LNP
 - 3. Corbin ML2000 Series PS
 - 4. Best 45H Series 14H
- B. Mortise Locks: Complying with BHMA A156.13, Grade 1.
 - 1. Latchbolt Throw: 3/4 inch (19 mm), minimum.
 - 2. Deadbolt Throw: 1 inch (25.4 mm), minimum.
 - 3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
 - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.
 - 5. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
 - 6. Length of strike lip shall be sufficient to clear surrounding trim.
 - 7. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.06 CLOSERS

- A. Manufacturers; Surface Mounted:
 - 1. LCN, an Allegion brand; 4011 Series: www.allegion.com/us/#sle.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Closers: Comply with BHMA A156.4, Grade 1.
 - 1. Type: Surface mounted to door.
 - 2. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
 - 3. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
 - 4. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
 - 5. Closers shall use high strength cast cylinders, forged main arms, and 1 piece forged steel pistons.

6. Closers shall utilize a stable fluid withstanding temperature range of +120 deg F to -30 deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
7. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
8. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
9. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
10. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
11. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
12. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100 hour salt spray test.
13. Pressure Relief Valve, PRV, shall not be acceptable.

2.07 OVERHEAD STOPS AND HOLDERS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Surface Mount:
 - a. Glynn-Johnson GJ900 Series
 - b. Rixson 9 Series
 - c. Sargent 590
- B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
 1. Overhead stops (including slide block and end caps) shall be fabricated from metal.
 2. Unless otherwise specified, furnish GJ900 series overhead stop for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
 3. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
 4. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
 5. Do not provide holder function for labeled doors.

2.08 PROTECTION PLATES

- A. Acceptable manufacturers and respective catalog numbers:
 1. Rockwood K1050
 2. Hager 190S
 3. Ives 8400
 4. Hiawatha J102
- B. Protection Plates: Comply with BHMA A156.6.
 1. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.

2. Protective plates shall be 2" less door width, or 1" less door width at pairs. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.
 3. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
 4. 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.
- C. Metal Properties: Stainless steel.
1. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.
- D. Edges: Beveled, on four sides unless otherwise indicated.
- E. Fasteners: Countersunk screw fasteners.

2.09 WALL STOPS

- A. Acceptable manufacturers and respective catalog numbers:
1. Wrought Concave Wall Bumper:
 - a. Ives WS406
 - b. Hager 236W
 - c. Burns 575
 - d. Rockwood 409
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.
 2. Where wall stops are not applicable, furnish overhead stops.
 3. Do not provide holder function for labeled doors.

2.10 KEY CONTROL SYSTEMS

- A. Key Control Systems: Comply with guidelines of BHMA A156.28.
1. Provide keying information in compliance with DHI (KSN) standards.
 2. Keying: Grand master keyed.
 3. Include control keying with removable core cylinders.
 4. Supply keys in following quantities:
 - a. 1 each Grand Master keys.
 - b. 2 each Control keys if new system.
 - c. 2 each Change keys for each keyed core.
 5. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
 6. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
 7. Owner or Owner's agent install permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.11 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.

2. Secondary Finish: 630; satin stainless steel, with stainless steel 3000 series base material (former US equivalent US32D); BHMA A156.18.
 - a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
 - b. Use secondary finish in exterior or high humidity locations.
3. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
 - b. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
 - c. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
 - d. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- C. Use templates provided by hardware item manufacturer.
- D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
 3. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch (1024 mm).

3.03 ADJUSTING

- A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08 7105 - HARDWARE GROUPS

HDWE GROUP 3.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Classroom Lockset	L9070	SCH
1 EA	Wall Stop	WS406	IVE
1 EA	Kick Plate	8400 10" x 2" LDW B4E	VON

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 4.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Storeroom Lock	L9080	SCH
1 EA	Wall Stop	WS406	IVE
1 EA	Kick Plate	8400 10" x 2" LDW B4E	VON

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked.

HDWE GROUP 12.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Privacy w/ DB & indicator	L9456 OS-OCC	SCH
1 EA	Surface Closer	4011 EDA TELE	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE

Function:

Lever retracts latchbolt from either side. Deadbolt thrown or retracted by key outside (retraction by key required in the event of an emergency) or inside thumbturn. Throwing deadbolt locks outside lever and displays "occupied" plate. Rotating inside lever simultaneously retracts both deadbolt and latchbolt and unlocks outside lever.

HDWE GROUP 12.1

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Privacy w/ DB & indicator	L9456 OS-OCC	SCH
1 EA	Surface Closer	4011 EDA TELE	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Overhead stop	90S	GLY

Function:

Lever retracts latchbolt from either side. Deadbolt thrown or retracted by key outside (retraction by key required in the event of an emergency) or inside thumbturn. Throwing deadbolt locks outside lever and displays "occupied" plate. Rotating inside lever simultaneously retracts both deadbolt and latchbolt and unlocks outside lever.

END OF SECTION

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glazing units.
- B. Plastic films.
- C. Glazing compounds.

1.02 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- F. BS EN 14179-1 - Glass in Building - Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass - Part 1: Definition and Description; 2016.
- G. GANA (SM) - GANA Sealant Manual; 2008.
- H. ITS (DIR) - Directory of Listed Products; current edition.
- I. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Test results from heat soaking.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.05 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

- B. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com.
 - 2. Guardian Glass, LLC: www.guardianglass.com.
 - 3. Oldcastle Building Envelope: obe.com.
 - 4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated. All glazing shall be tempered as required by codes, and as required to meet thermal stress and wind loads.
 - 1. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 - 3. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on all applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with BS EN 14179-1.
 - a. Tint: Clear.
 - b. Coating: Same as on vision units, on #2 surface.

2.03 GLAZING UNITS

- A. Monolithic Safety Glazing: Non-fire-rated.
 - 1. Applications: Interior glazing, unless otherwise indicated.
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 - 2. Glass Type: Fully tempered float glass.
 - 3. Tint: Clear.
 - 4. Glass Type: Fully tempered safety glass as specified.
 - a. Thickness:
 - 1) (GL-1): 1/4 inch (6.4 mm), nominal.
 - 5. Tint: Clear.

2.04 PLASTIC FILMS

- A. Decorative Plastic Film (FILM-1): Polyester type.
 - 1. Basis of Design: 3M Window Film; Crystal Frosted Decorative Privacy Glazing Film.
 - 2. Application: Locations as indicated on drawings.

2.05 GLAZING COMPOUNDS

- A. Manufacturers:
 - 1. Bostik Inc: www.bostik-us.com.
 - 2. Dow Corning Corporation: www.dowcorning.com/construction.

3. Momentive Performance Materials, Inc: www.momentive.com.
4. Pecora Corporation: www.pecora.com.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- C. Verify that sealing between joints of glass framing members has been completed effectively.
- D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - PLASTIC FILM

- A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- B. Place without air bubbles, creases or visible distortion.
- C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.06 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.
- H. Acoustic (sound-dampening) wall and ceiling board.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2024.
- H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- J. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.
- K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- M. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- N. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- O. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
- P. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- C. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Gypsum Association File Numbers: Comply with requirements of GA-234 and GA-600 for the particular assembly.
 - 2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.03 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Sustainability Requirements: Manufacturers must be able to provide the following, or acceptable alternate, product documentations:
 - 1. Environmental Product Declaration (EPD) or Declare Label.
 - 2. Health Product Declaration (HPD).
- C. Basis of Design: ClarkDietrich; www.clarkdietrich.com.
- D. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements - Metal Framing, Connectors, and Accessories:
 - 1. MarinoWARE: www.marinoware.com/#sle.
 - 2. SCAFCO Corporation: www.scafco.com.
 - 3. Steel Construction Systems: www.steelconsystems.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- E. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
 - 1. Provide minimum CP 90 corrosion protection where installed in exterior applications and humid environments.
 - 2. Studs: "C" shaped with flat or formed webs with knurled faces.
 - a. (MET STUD-2): Provide 20 gauge studs unless noted otherwise.
 - 3. Runners: U shaped, sized to match studs.
 - 4. Furring Members : Zee-shaped sections, minimum depth as indicated on drawings.

2.04 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. CertainTeed Corporation: www.certainteed.com/.
 - 2. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 3. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com.
 - 4. USG Corporation: www.usg.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Material ID:
 - a. (GY BD-1): 5/8 inch Type X.
 - 2. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 4. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - a. Living Building Challenge Red List Free or Compliant.
 - b. Declare Label.
 - c. Environmental Product Declaration (EPD).
 - d. Health Product Declaration (HPD).
 - 5. Basis of Design: USG Corporation; Sheetrock Brand EcoSmart Gypsum Panels: www.usg.com.
 - 6. Other Acceptable Paper-Faced Products provided they meet or exceed the Basis of Design performance requirements:
 - a. CertainTeed Corporation; Type X Drywall: www.certainteed.com.
 - b. Georgia-Pacific Gypsum; ToughRock: www.gpgypsum.com.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Impact Rated Wallboard (GY BD-10): Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
 - 1. Application: High-traffic areas indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Type: Fire-resistance-rated Type X, UL or WH listed.
 - 4. Thickness: 5/8 inch (16 mm).
 - 5. Edges: Tapered.
 - 6. Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com/#sle.
 - b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
 - c. USG Corporation; Sheetrock Brand Mold Tough VHI Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Acoustical Sound Dampening Wall and Ceiling Board (GY BD-8): Two layers of heavy paper-faced, high-density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating of

50 or more in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.

1. Thickness: 5/8 inch (16 mm).
2. Long Edges: Tapered.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Products:
 - a. QuietRock ES: www.quietrock.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation (INSUL-80): ASTM C665; preformed fiber glass or mineral fiber, friction fit type, unfaced. Thickness: 3-1/2 inch (84 mm), minimum. Insulation should fill the cavity.
 1. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - a. Living Building Challenge Red List Free or Compliant.
 - b. Declare Label.
 - c. Environmental Product Declaration (EPD).
 - d. Health Product Declaration (HPD).
 2. Basis of Design: Owens Corning Unfaced Ecotouch Insulation.
 - a. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place continuous bead at perimeter of each layer of gypsum board.
 - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
 - 2. Provide a control joint at both sides of the wall at every door frame. Locate at hinge side of door.
 - 3. Provide a control joint at both sides of the wall at openings in the wall. Provide on one side of the opening for openings 48 inches wide or less. For openings over 48 inches, provide on both sides of the opening.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

- 4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.
- B. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
- C. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
- D. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
- E. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- F. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.
- G. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.
- H. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.
- I. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Provide two tiles, actual size, illustrating pattern and color.
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 sq ft (1 sq m) of each size, color, and surface finish combination.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

1.08 WARRANTY

- A. Tile and Stone Installation System Warranty: Manufacturer's standard system warranty protecting against break down or deterioration of the tile setting system under normal usage, and ensuring the products are free from manufacturer defects. Manufacturer shall pay for replacement of its own products and replacement of finishing materials, including labor, for defective portions of the project.
 - 1. Warranty Period: 25 years.

PART 2 PRODUCTS

2.01 TILE

- A. Tile (T-#): ANSI A137.1 standard grade.
 - 1. Basis of Design: See drawings for product information.

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim (MT-#): Brushed stainless steel, style and dimensions to suit application, set with tile mortar or adhesive.
 - 1. Basis of Design: See drawings for product information.

2.03 SETTING MATERIALS

- A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 - 1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
 - a. Typical Floors:
 - 1) LATICRETE 254 Platinum.
 - 2) TEC Specialty Full Flex.
 - b. Typical Walls:
 - 1) LATICRETE Tri Lite.
 - 2) TEC Specialty Ultimate Large Tile.
 - 2. Products:
 - a. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
 - b. LATICRETE International, Inc: www.laticrete.com/#sle.
 - c. Mapei Corporation: www.mapei.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

- A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout for typical walls.

2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
3. Color: As selected by Architect from manufacturer's full line.
4. Basis of Design:
 - a. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
 - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Select Grout: www.laticrete.com/#sle.
 - c. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 1. Applications: Use where indicated on drawings.
 2. Color: As selected by Architect from manufacturer's full line.
 3. Basis of Design:
 - a. Tile Floors:
 - 1) H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com.
 - 2) LATICRETE International, Inc; LATICRETE SpectraLOCK PRO Premium Grout.
 - 3) Mapei Corporation: www.mapei.com.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 1. Applications: Between tile and plumbing fixtures.
 2. Color: As selected by Architect from manufacturer's full line.
 3. Products:
 - a. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
 - b. TEC Specialty; Silicone Caulk.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORY MATERIALS

- A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 1. Application: Provide at walls, ceilings and floors in showers only.
 2. Fluid or Trowel Applied Type:
 - a. Products:
 - 1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 2) TEC Specialty; HydraFlex.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.
- B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Vacuum clean surfaces and damp clean.
- B. Seal substrate surface cracks with filler.
- C. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F115, with epoxy grout. Provide waterproofing membrane under all tile.
 - 1. Use uncoupling membrane under tile unless other underlayment is indicated on drawings.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
- B. Grout with standard grout.

3.06 INSTALLATION - WALL TILE

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
- B. Over gypsum wallboard on wood or metal studs, install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat.

3.07 CLEANING

- A. Clean tile and grout surfaces.

3.08 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Divisions 21 through 28 for mechanical and electrical components in acoustical ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. USG Corporation: www.usg.com/ceilings.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Rockfon, LLC: www.rockfon.com.
 - 4. USG Corporation: www.usg.com/ceilings.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. VOC Content: As specified in Section 01 6116.
- B. Acoustical Panels (ACT-#):
 - 1. Basis of Design: See drawings for product information.

2.03 SUSPENSION SYSTEMS

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
 - 1. Profile: Tee; 15/16 inch (24 mm) face width.
 - 2. Finish: Baked enamel.
 - 3. Color: White.
- C. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
 - 1. Profile: Tee; 9/16 inch (14 mm) face width.
 - 2. Finish: Baked enamel.
 - 3. Color: White.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions.
 - 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions, as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Miter corners.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
 - 2. Double cut and field paint exposed reveal edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

- A. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 100 square feet (9.29 square meters) of each type and color.
 - 3. Extra Wall Base: 20 linear feet (6.1 linear meters) of each type and color.

1.05 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.06 WARRANTY

- A. Manufacturer's standard limited 5 year commercial warranty.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Rubber Tile (RBT-1): Type I- Homogeneous, color and pattern throughout thickness; Type II- Heterogeneous, laminated.
 - 1. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
 - 2. Size: 18 by 18 inch (457 by 457 mm) nominal.
 - 3. Total Thickness: 0.125 inch (3.2 mm).

2.02 RESILIENT BASE

- A. Resilient Base (RB-#): ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
 - 1. Basis of Design: See drawings for product information.
 - 2. Height: 4 inches (100 mm).
 - 3. Thickness: 0.125 inch (3.2 mm).
 - 4. Finish: Satin.
 - 5. Length: Roll.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips (RTS-1): Same material as resilient base color to match.
- D. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is fully cured.
- C. Clean substrate.
- D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern, unless indicated otherwise in drawings.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Tile Carpeting (CPT-#): Each type manufactured in one color dye lot.
 - 1. See drawings for schedule of carpet tiles.

2.02 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

- B. Edge Strips: Rubber, color as selected by Architect.
- C. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Trim carpet tile neatly at walls and around interruptions.
- F. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convectors and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, and convectors and baseboard cabinets to match face panels.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Ceramic and other tiles.
 - 8. Glass.
 - 9. Acoustical materials, unless specifically indicated.
 - 10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- D. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
 - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Primer Sealers: Same manufacturer as top coats.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: See Section 01 6116.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors (PT-#): As indicated on drawings.
 - 1. Allow for minimum of six colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, uncoated steel, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Latex.
 - a. Basis of Design Products:
 - 1) Benjamin Moore Ultra Spec 500.
 - 2) Sherwin-Williams ProMar 200 Zero VOC.
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:

1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades, unless noted otherwise.
2. Two top coats and one coat primer.
3. Top Coat(s): High Performance Architectural Interior.
 - a. Basis of Design Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
 - 2) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
 1. Shop primer by others.
 2. One top coat.
 3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
 - a. Basis of Design Products:
 - 1) Sherwin-Williams Waterborne Acrylic Dryfall, Eg-Shel. (MPI #155, 226)
 4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.

- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 1423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panel signage.

1.02 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
 - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - c. Submit for approval by Owner through Architect prior to fabrication.
- D. Verification Samples: Submit samples showing colors, materials, and finishes specified.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store under cover and elevated above grade.
- D. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Panel Signage:
 - 1. Best Sign Systems, Inc: www.bestsigns.com.
 - 2. Inpro Corporation: www.inprocorp.com.
 - 3. Mohawk Sign Systems, Inc: www.mohawksign.com.

4. Seton Identification Products: www.seton.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 PANEL SIGNAGE

- A. Panel Signage:
 1. Application: Room and door signs.
 2. Description: Flat signs with engraved panel media, tactile characters.
 3. Sign Size: As indicated on drawings.
 4. Total Thickness: 1/8 inch (3 mm).
 5. Color and Font, unless otherwise indicated:
 - a. Character Font: Helvetica, Arial, or other sans serif font.
 - b. Character Case: Upper and lower case (title case).
 - c. Background Color: As scheduled.
 - d. Character Color: Contrasting color.
 6. Material: Laminated colored plastic engraved through face to expose core as background color.
 7. Profile: Flat panel without frame.
 - a. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non glare on front.
 8. Tactile Letters: Raised 1/32 inch minimum.
 9. Braille: Grade II, ADA-compliant.
 10. One-Sided Wall Mounting: Tape adhesive.

2.04 SIGNAGE APPLICATIONS

- A. Room and Door Signs:
 1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
 2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
 3. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- B. Interior Directional and Informational Panel Signs:
 1. Directories: For customer-produced media; provide divider strips.
 2. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.
- C. Emergency Evacuation Map Panel Signs:
 1. Allow for one map per elevator lobby.
 2. Map content to be provided by Owner.
- D. Recognition/Donor Panels:
 1. Individual name signs attached with magnetic tape to fixed panel.
 2. Dimensions and number of name signs: As indicated on drawings.

- 3. Provide all name signs whether engraved or not, for uniform overall appearance.
- E. Traffic Signs: To match campus standards; locate where indicated on drawings.

2.05 ACCESSORIES

- A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010, with Editorial Revision (2015).
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 6 inches (152 mm) long.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures or internal connection failures.

- b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Construction Specialties, Inc: www.c-sgroup.com.
 - 2. Inpro: www.inprocorp.com.
 - 3. Koroseal Interior Products: www.koroseal.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted (CG-3):
 - 1. Material: Type 304 stainless steel, No. 4 satin finish, 20 gauge, minimum thickness; surface mount.
 - 2. Width of Wings: 2 inches (51 mm)
 - 3. Corner: Square.
 - 4. Length: As indicated on drawings.
- B. Adhesives and Primers: As recommended by manufacturer.
- C. See Section 06 1000 for wood blocking for wall and corner guard anchors.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch (6 mm).
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.04 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Utility room accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2024.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com.
 - 2. Bradley Corporation: www.bradleycorp.com.
 - 3. Bobrick Washroom Equipment Inc: www.bobrick.com.
 - 4. Substitutions: Section 01 6000 - Product Requirements.
- B. Provide products of each category type by single manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Frameless Mirrors (MIR-50): Frameless, 6 mm thick mirror.
 - 1. Size: As indicated on drawings.
 - 2. Installation: Secure mirror with metal mounting clips to wall with screws, then engage mirror into clips.
 - 3. Basis of Design: 747 Series manufactured by Bradley.
- B. Grab Bars: Stainless steel, textured surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration (see drawings for which of the following are used):
 - 1) (GB-18): 18 inches. Basis of Design 812 Series by Bradley.
 - 2) (GB-36): 36 inches. Basis of Design 812 Series by Bradley.
 - 3) (GB-42): 42 inches. Basis of Design 812 Series by Bradley.

2.05 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder (MOP-1): 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
 - 1. Basis of Design: Model 9933 manufactured by Bradley.
 - 2. Hooks: Two, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.
 - 5. Provide one in each janitor's closet, locations indicated as (MOP-1), unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Division 22 - Plumbing fixtures, sinks.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- F. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Installation Instructions: Manufacturer's installation instructions and recommendations.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

- B. Solid Surfacing Countertops (SSM-#): Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Basis of Design: See drawings for product information.
 - 2. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 - 3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - 4. Other Components Thickness: 1/2 inch (12 mm), minimum.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

2.02 MATERIALS

- A. Wood-Based Components:
 - 1. Wood fabricated from old growth timber is not permitted.
 - 2. Provide sustainably harvested wood, certified or labeled; see Section 01 6000 - Product Requirements.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- C. Countertop Support Members: Furniture grade, epoxy powder coated steel.
 - 1. Basis of Design: Rakks Model EH-1818FM with cover bracket as manufactured by Rangine Corporation or approved equal.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches (102 mm), unless otherwise indicated.
 - 3. Detail top of backsplash to allow scribing of backsplash to wall.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach countertops using compatible adhesive as well as mechanical fasteners.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING

- A. Clean countertops surfaces thoroughly.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 21 05 00 – COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe, fittings, valves, and connections for wet pipe and standpipe systems.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
 - 2. ASME B16.25 - Buttwelding Ends.
 - 3. ASME B16.3 - Malleable Iron Threaded Fittings.
 - 4. ASME B16.4 - Gray Iron Threaded Fittings.
 - 5. ASME B16.5 - Pipe Flanges and Flanged Fittings.
 - 6. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
- B. ASTM International:
 - 1. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 2. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- C. National Fire Protection Association:
 - 1. NFPA 13 - Installation of Sprinkler Systems.
 - 2. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
 - 3. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.
 - 4. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.3 SYSTEM DESCRIPTION

- A. Fire suppression system to be wet-sprinkler type. Refer to Section 21 13 13.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and tag numbering.
- B. Operation and Maintenance Data: Submit spare parts lists.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with NFPA 13 and any insurance requirements
- C. All materials used to be UL listed.
- D. Commercial Cooking Equipment and Ventilation Applications: Perform work in accordance with NFPA 13, NFPA 96, Minnesota Mechanical Code, and Minnesota Fire Code.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Furnish cast iron and steel valves with temporary protective coating.
- C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 COORDINATION

- A. Fire Protection Contractor shall be required to coordinate installation requirements and construction schedules to install equipment in existing facilities.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are required.
- C. Coordinate requirements for access panels and doors with General Contractor if fire suppression items installed in concealed locations require access.

1.10 WARRANTY

- A. Furnish one year manufacturer warranty for basic fire suppression materials and methods (excludes existing systems).

PART 2 PRODUCTS

2.1 VALVES

- A. Gate Valves:
 - 1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
 - 2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged ends.
 - 3. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, and iron body indicator post assembly.
- B. 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.
 - 2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.
- C. Ball Valves:
 - 1. Up to and including 2 inches: Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, Teflon seats and stuffing box ring, lever handle, threaded ends.
 - 2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.
- D. Butterfly Valves:
 - 1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device.
 - 2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile 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.
- E. 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.
- F. 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 A795 UL listed; Schedule 10 black.
1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
 2. Cast Iron Fittings: ASME B16.4, threaded fittings.
 3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - a. Grooved Reducer Couplings: Not Allowed.
 5. Mechanical Formed Fittings: Carbon-steel housing with integral pipe stop and O-ring pocked and O-ring uniformly compressed into permanent mechanical engagement onto pipe.

2.3 PIPE HANGERS AND SUPPORTS

- A. Wet Sprinkler Systems: Conform to NFPA 13
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. In exposed areas, 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.

3.2 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
 - 1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
 - 2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- G. Pipe Hangers and Supports:
 - 1. Install in accordance with NFPA 13 for wet sprinkler systems and NFPA 14 for standpipe systems.
 - 2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.
- I. Do not penetrate building structural members unless indicated.
- J. Projects with existing systems: piping connecting to existing systems shall match the materials and methods of the existing system.
- 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 after installation.
- N. Install 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 recessed into and grouted flush with slab.

3.3 CLEANING

- A. Only clean areas affected by Work. Clean after other construction is complete.

END OF SECTION

SECTION 21 13 13 – 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 21 05 00 - Common Work Results for Fire Suppression: Product and execution requirements for pipe, fittings, valves, hangers, supports, identification, and painting for placement by this section.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 13 - Installation of Sprinkler Systems.
 - 2. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - 3. NFPA 101 – Life Safety Code.
 - 4. NFPA 654 – Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Solids.
- B. National Institute for Certification in Engineering Technologies:
 - 1. Level III – Hydraulics and Water Supply Planning.

1.3 SYSTEM DESCRIPTION

- A. System to provide coverage for entire building
- B. Provide hydraulically designed system to NFPA 13 occupancy requirements. System to have a minimum safety factor of 5 PSI.
- C. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data become available prior to submittals.
- D. Interface system with building fire and smoke alarm system.
- E. Provide fire department connections as required by Authority Having Jurisdiction.
- F. Additional compensation will not be allowed for modification to the Construction Documents for additional piping, sprinklers, offsets, coordination, or additional hydraulic calculations.

1.4 SUBMITTALS

- A. 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.
- B. 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.
- C. Design Data: Submit design calculations.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

- B. 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.
- B. All materials used are to be UL listed.
- C. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Design system under direct supervision of a licensed Professional Engineer or a NICET Level III Certified Technician.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers until installation.
- B. Furnish piping with temporary inlet and outlet caps until installation.

1.9 WARRANTY

- A. Furnish one year manufacturer warranty for all items included in the fire sprinkler systems (excludes existing systems).

1.10 EXTRA MATERIALS

- A. Furnish extra sprinklers under provisions of NFPA 13.
- B. Furnish suitable wrenches for each sprinkler type.
- C. Furnish metal storage cabinet near system riser (not necessary for existing systems with furnished cabinet).

PART 2 PRODUCTS

2.1 WET-TYPE SPRINKLERS

- A. Manufacturers:
 - 1. Globe Sprinkler
 - 2. Reliable Sprinkler
 - 3. Tyco Sprinkler
 - 4. Victaulic Sprinkler
- B. Suspended Ceiling Type:
 - 1. Type: Concealed pendant type with matching escutcheon plate.
 - 2. Finish: Enamel, color white (or match existing).
 - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- C. Exposed Area Type:
 - 1. Type: Standard upright or pendent type.
 - 2. Finish: Brass (or match existing).
 - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

- D. Sidewall Type (Type 1):
 - 1. Type: Recessed horizontal sidewall type with matching push on escutcheon plate.
 - 2. Finish: Chrome plated (or match existing).
 - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- E. Sidewall Type (Type 2):
 - 1. Type: Standard horizontal sidewall type.
 - 2. Finish: Brass (or match existing).
 - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- F. Escutcheon Plate: Finish to match sprinkler finish
- G. Guards: Finish to match sprinkler finish.

2.2 PIPE

- A. Refer to Section 21 05 00.
- B. Drains may be of any acceptable piping for fire sprinkler systems.

2.3 FITTINGS

- A. Refer to Section 21 05 00.
- B. All fittings to be rated for a minimum of 125 PSI.

2.4 VALVES

- A. Refer to Section 21 05 00.
- B. All valves to be mechanically coupled, flanged, or threaded.
- C. System Riser Valves:
 - 1. Indicating Type Butterfly Valves, or
 - 2. Outside Screw and Yoke Gate Valves.
- D. Electronic Supervision:
 - 1. Valves that shut down water flow to any areas of the sprinkler systems shall be electronically supervised.
 - 2. Valves for main or auxiliary drains do not need to be electronically supervised.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. All wiring for the sprinkler system to be provided by the Sprinkler Contractor and installed by a licensed Electrician.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 13.
- B. Place pipe runs to minimize obstruction to other work.
- C. Install piping in concealed spaces above finished ceilings.
- D. Assembly Penetrations
 - 1. Exposed Areas: Provide escutcheons for wall penetrations. Escutcheons to have chrome finish.
 - 2. Fire-rated Assemblies: Provide UL listed firestopping system with a fire rating no less than the rated assembly.
 - 3. Smoke-rated Assemblies: Provide UL listed smoke control system with a smoke rating no less than the rated assembly.
- E. Center sprinklers in two directions in ceiling tile and install piping offsets.

- F. Install guards on sprinklers less than 7 feet above the finished floor.
- G. Hydrostatically testing
 - 1. New Construction: Test entire system.
 - 2. Existing Systems: Test modified systems.
- H. Require test be witnessed by Authority Having Jurisdiction

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Verify signal devices are installed and connected to fire alarm system.

3.3 CLEANING

- A. Refer to Section 21 05 00.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting.

END OF SECTION

SECTION 22 05 29 – HANGERS & SUPPORTS FOR PLBG PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Hanger rods.
 - 3. Inserts.
 - 4. Flashing.
 - 5. Sleeves.
 - 6. Mechanical sleeve seals.
 - 7. Formed steel channel.
 - 8. Firestopping relating to plumbing work.
 - 9. Firestopping accessories.
 - 10. Equipment bases and supports.
- B. Related Sections:
 - 1. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
 - 2. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
 - 3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.

1.2 REFERENCES

- A. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- B. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

1.3 SUBMITTALS

- A. NONE.

1.4 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 COORDINATION

- A. Coordinate Work with other trades.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Anvil International (Mueller Water Products, Inc.).
 - 2. Carpenter & Paterson Inc.
 - 3. Creative Systems Inc.
 - 4. Flex-Weld, Inc.
 - 5. Globe Pipe Hanger Products Inc.
 - 6. Michigan Hanger Co.
 - 7. Superior Valve Co.
- B. Plumbing Piping - DWV:
 - 1. Conform to MSS SP 69.
 - 2. Hangers for Pipe Sizes ½- to 1-½-inch: Malleable iron or Carbon steel, adjustable, clevis.
 - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 7. Vertical Support: Steel riser clamp.
 - 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
 - 10. For Exterior and Humid Areas: Furnished hot-dipped galvanized or Type 304 stainless steel or better hangers, support, and hardware.
- C. Plumbing Piping - Water:
 - 1. Conform to MSS SP 69.
 - 2. Hangers for Pipe Sizes ½- to 1-½-inch: Malleable iron or Carbon steel, adjustable, clevis.
 - 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 - 5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
 - 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
 - 8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 - 11. Vertical Support: Steel riser clamp.
 - 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 - 15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

16. For Exterior and Humid Areas: Furnished hot-dipped galvanized or Type 304 stainless steel or better hangers, support, and hardware.

2.2 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of 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.

2.4 FLASHING

- A. See Division 07.

2.5 SLEEVES

- A. Sleeves for Pipes Through Non-fire-rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire-rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic.

2.6 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 1. Thunderline Link-Seal, Inc.
 2. NMP Corporation.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber-sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-½-inches on center.

2.8 FIRESTOPPING

- A. Refer to Division 07.

2.9 FIRESTOPPING ACCESSORIES

- A. Refer to Division 07.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

- A. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.

- B. Install 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 recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with MSS SP 69.
- B. Support horizontal piping as scheduled. Coordinate with Structural Drawings.
- C. Support vertical piping as scheduled.
- D. Install hangers with minimum ½-inch space between finished covering and adjacent work.
- E. Place hangers within 12 inches of each horizontal elbow.
- F. Use hangers with 1-½-inch minimum vertical adjustment.
- G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports for copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
- N. Provide vibration isolators type hangers or supports for pipes after vibration-isolated equipment is installed. Refer to Section 23 05 48.
- O. Provide vibration isolators type hangers for pipes 2-inches or larger located below or within 50 feet of noise-sensitive rooms. Refer to Section 23 05 48.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Refer to Section 23 05 29 for installation requirements.

3.6 INSTALLATION - FLASHING

- A. Refer to Division 07.

3.7 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

- A. Install firestopping material at fire and smoke-rated construction perimeters and openings containing penetrating sleeves, piping, and other items that require firestopping.
- B. Refer to Division 07.

3.9 PROTECTION OF FINISHED WORK

- A. Protect adjacent surfaces from damage by material installation.

3.10 SCHEDULES

HANGERS AND SUPPORTS (TABLE 313.1) MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
CAST	LEAD AND OAKUM	5 FEET, EXCEPT 10 FEET WHERE 10 FOOT LENGTHS ARE INSTALLED (NOTES 1,2,3)	BASE AND EACH FLOOR, NOT TO EXCEED 15 FEET
CAST	COMPRESSION GASKET	EVERY OTHER JOINT, UNLESS OVER 4 FEET THEN SUPPORT EACH JOINT (NOTES 1,2,3)	BASE AND EACH FLOOR, NOT TO EXCEED 15 FEET
CAST-IRON HUBLESS	SHEILDED COUPLING	EVERY OTHER JOINT, UNLESS OVER 4 FEET THEN SUPPORT EACH JOINT (NOTES 1,2,3,4)	BASE AND EACH FLOOR, NOT TO EXCEED 15 FEET
COPPER TUBE AND PIPE	SOLDERED OR BRAZED	1-1/2 INCHES AND SMALLER, 6 FEET; 2 INCHES AND LARGER, 10 FEET	EACH FLOOR, NOT TO EXCEED 10 FEET (NOTE 5)
STEEL AND BRASS PIPE FOR WATER OR DWV	THREADED OR WELDED	3/4 INCH AND SMALLER, 10 FEET; 1 INCH AND LARGER, 12 FEET	EVERY OTHER FLOOR, NOT TO EXCEED 25 FEET (NOTE 5)
STEEL, BRASS, AND TINNED COPPER PIPE FOR GAS	THREADED OR WELDED	1/2 INCH, 6 FEET; 3/4 INCH AND 1 INCH, 8 FEET; 1-1/4 INCHES AND LARGER, 10 FEET	1/2 INCH, 6 FEET; 3/4 INCH AND 1 INCH, 8 FEET; 1-1/4 INCHES EVERY FLOOR LEVEL
SCHEDULE 40 PVC AND ABS DWV	SOLVENT CEMENTED	ALL SIZES, 4 FEET; ALLOW FOR EXPANSION EVERY 30 FEET (NOTES 3,6)	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES; PROVIDE FOR EXPANSION EVERY 30 FEET (NOTE 6)
CPVC	SOLVENT CEMENTED	1 INCH AND SMALLER, 3 FEET; 1-1/4 INCHES AND LARGER, 4 FEET	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES (NOTE 6)
LEAD	WIPED OR BURNED	CONTINUOUS SUPPORT	NOT TO EXCEED 4 FEET
COPPER	MECHANICAL	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION
STEEL AND BRASS	MECHANICAL	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE

		THE AUTHORITY HAVING JURISDICTION	AUTHORITY HAVING JURISDICTION
PEX	COLD EXPANSION, INSERT AND COMPRESSION	1 INCH AND SMALLER, 32 INCHES; 1-1/4 INCHES AND LARGER, 4 FEET	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES
PEX-AL-PEX	METAL INSERT AND METAL COMPRESSION	1/2 INCH, 3/4 INCH, 1 INCH; ALL SIZES 98 INCHES	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES
PE-AL-PE	METAL INSERT AND METAL COMPRESSION	1/2 INCH, 3/4 INCH, 1 INCH; ALL SIZES 98 INCHES	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES
POLYPROPYLENE (PP)	FUSION WELD (SOCKET, BUTT, SADDLE, ELECTROFUSION), THREADED (METAL THREADS ONLY), OR MECHANICAL	1 INCH AND SMALLER, 23 INCHES; 1-1/4 INCHES AND LARGER, 4 FEET	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES

NOTES:

1. SUPPORT ADJACENT TO JOINT, NOT TO EXCEED 18 INCHES.
2. BRACE NOT TO EXCEED 40 FOOT INTERVALS TO PREVENT HORIZONTAL MOVEMENT.
3. SUPPORT AT EACH HORIZONTAL BRANCH CONNECTION.
4. HANGERS SHALL NOT BE PLACED ON THE COUPLING.
5. VERTICAL WATER LINES SHALL BE PERMITTED TO BE SUPPORTED IN ACCORDANCE WITH RECOGNIZED ENGINEERING PRINCIPLES WITH REGARD TO EXPANSION AND CONTRACTION, WHERE FIREST APPROVED BY THE AUTHORITY HAVING JURISDICTION.
6. SEE THE APPROPRIATE IAPMO INSTALLATION STANDARD FOR EXPANSION AND OTHER SPECIAL REQUIREMENTS.

HANGER AND ROD SIZES (TABLE 313.6)

PIPE AND TUBE SIZE	ROD SIZE
(INCHES)	(INCHES)
1/2 - 4	3/8
5 - 8	1/2
10 - 12	5/8

END OF SECTION

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Stencils.
 - 4. Pipe markers.
 - 5. Ceiling tacks.
 - 6. Labels.
 - 7. Lockout devices.
- B. Related Sections:
 - 1. NONE.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. National Fire Protection Association:
 - 1. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

- A. The Plumbing Contractor is responsible for items in this Section.

1.4 SUBMITTALS

- A. NONE.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

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 square.
- B. Metal Tags:
 - 1. Brass, Aluminum, or Stainless Steel with stamped letters; tag size minimum 1-½-inches square with finished edges.
- C. Information Tags:
 - 1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-¼ x 5-5/8 inches with grommet and self-locking nylon ties.
- D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum or plastic laminated frame.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Insulation or Pipe: ½-inch high letters.
 - 2. 2-½ to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
 - 3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-¾ inches high letters.
 - 4. Ductwork and Equipment: 1-¾ inches high letters.
- B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PLASTIC MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Markers:
 - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Markers:
 - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Markers:
 - 1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

- A. Description: Steel or plastic with ¾-inch diameter color-coded head.
- B. Color code as approved by Owner. If no preference by Owner, color as follows:
 - 1. Plumbing valves: Green.
 - 2. Refer to Section 23 05 53 for other equipment.

2.6 LABELS

- A. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

- A. Lockout Hasps:
 - 1. Reinforced nylon hasp with erasable label surface; size minimum 7-¼ x 3 inches.
- B. Valve Lockout Devices:
 - 1. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Install piping identification on medical gas systems. Refer to Section 22 60 13.
- G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic markers, or plastic tape markers.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification:
 - a. Not to exceed 20 feet on straight runs including risers and drops.
 - b. Adjacent to each valve and tee.
 - c. At each side of penetration of structure or enclosure.
 - d. At each obstruction.
- K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 07 00 – PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Piping system insulation.
 - 2. Equipment insulation.
 - 3. Pipe insulation jackets.
 - 4. Equipment insulation jackets.
 - 5. Insulation accessories including vapor retarders and accessories.
- B. Related Sections:
 - 1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
 - 2. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for plumbing piping and equipment identification.
 - 3. Section 23 07 00 – HVAC Insulation: Pipe insulation thickness requirements.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
 - 2. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - 3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

- A. NONE.

1.4 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature during and after installation for minimum period as recommended by manufacturer.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE: MAN MADE MINERAL FIBER

- A. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I, 850 °F
 - 1. Insulation Conductivity Rating: Maximum: 0.28 Btu-in/(h-ft²-°F) at 100-°F mean rating temperature.
- B. Applications on Austenitic stainless steel: Conform to ASTM C795.
- C. Vapor Retarder Jacket:
 - 1. White Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- D. Vapor Retarder Lap Adhesive:
 - 1. Compatible with insulation.

2.2 PIPE INSULATION AND EQUIPMENT JACKETS

- A. PVC Plastic Pipe Jacket:
 - 1. Product Description: One-piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 10 mil.
 - 3. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping and equipment has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION – PIPING

- A. Exposed Piping: Locate insulation and cover seams in least visible locations.
- B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, [pump bodies,] and expansion joints.
- C. Manmade mineral fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. For hot piping conveying fluids over 140 °F, insulate flanges and unions at equipment.
- E. Manmade mineral fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- F. Inserts and Shields:

1. Application: Piping or Equipment 2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under finish jacket.
 4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be site fabricated or factory fabricated.
 5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.
- G. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- E. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- F. Mineral fiber insulated equipment containing fluids below ambient temperature: Provide vapor retarder jackets, factory-applied or field-applied. Finish with glass-cloth and vapor barrier adhesive.
- G. For hot equipment containing fluids over 140 °F, insulate flanges and unions with removable sections and jackets.
- H. Mineral fiber insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.
- I. Finish insulation at supports, protrusions, and interruptions.
- J. Nameplates and ASME Stamps: Bevel and seal insulation around. Do not insulate over.
- K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 SCHEDULES

- A. Plumbing Systems:
 1. Domestic Hot Water Systems:
 - a. Material: Man Made Mineral Fiber Insulation
 - b. Thickness:
 - 1) Pipe diameter less than 1-½-inches: 1 inch.
 - 2) Pipe diameter 1-½-inches and greater: 1-½-inches.
 2. Domestic Cold-Water Systems:
 - a. Material: Man Made Mineral Fiber Insulation
 - b. Thickness: 1 inch.
 3. Plumbing Vents Within 10 feet of Exterior:
 - a. Material: Man Made Mineral Fiber Insulation
 - b. Thickness: 1 inch.

END OF SECTION

SECTION 22 11 00 –FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Domestic water piping, above grade.
 - 2. Unions and flanges.
 - 3. Valves.
 - 4. Pipe hangers and supports.
 - 5. Thermometers.
 - 6. Flow control/balancing valves.
 - 7. Relief valves.
 - 8. Strainers.
 - 9. Backflow preventers.
 - 10. Water hammer arrestors.
 - 11. Thermostatic mixing valves.
- B. Related Sections:
 - 1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
 - 2. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
 - 3. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
 - 4. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
 - 5. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Execution requirements for pipe expansion devices for placement by this section.
 - 6. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.
- 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 B31.9 - Building Services Piping.
 - 4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
 - 5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- C. American Society of Sanitary Engineering:
 - 1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
 - 2. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
 - 3. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
 - 4. ASSE 1052 – Performance Requirements for Hose Connection Backflow Preventers.
 - 5. ASSE 1061 – Performance Requirements for Removable and Non-Removable Push-Fit Fittings.
- 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 B88 - Standard Specification for Seamless Copper Water Tube.
 5. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 6. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
 7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 8. ASTM E1 - Standard Specification for ASTM Thermometers.
 9. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
 10. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
 11. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
 12. ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water.
 13. ASTM F2389 – Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.
- E. American Water Works Association:
1. AWWA C651 - Disinfecting Water Mains.
- F. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 67 - Butterfly Valves.
 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.
- G. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- H. NSF International:
1. NSF 14 – Plastics Piping System Components and Related Materials.
 2. NSF 61 – Drinking Water System Components – Health Effects.
 3. NSF 372 – Drinking Water Components – Lead Content.
- I. Plumbing and Drainage Institute:
1. PDI WH201 - Water Hammer Arrestor Standard.
- J. U. S. Department of Housing and Urban Development:
1. FHA Bulletin 76 – Use of Materials Bulletin No. 76: Chlorinated Poly (Vinyl Chloride) CPVC and Polybutylene (PB) Hot and Cold-Water Distribution Piping.

1.3 SYSTEM DESCRIPTION

- A. The Plumbing Contractor is responsible for items in this Section.
- B. Water distribution system to be either copper or polypropylene-random (PP-R).
- C. Pipe sizes indicated on drawings are based on ASTM B88 Type L copper tubing and ASTM A53/A53M, Schedule 40 steel pipe. For non-metallic pipe, contractor to verify nominal pipe size for equivalent pressure drop, flow rate, and velocity.

1.4 SUBMITTALS

- A. Product Data:

1. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
2. 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.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of valves and equipment.
- B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.
- C. Pressure Test Report: Submit verification of pressure test report. Include test type, testing pressure, and length of time.
 1. PP-R: Provide completed test report for Manufacturer's standard testing procedure.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. PB: Polybutylene systems (PB tubing together with recommended fittings) must be tested by the manufacturer at 150 psi and 210 °F for a period of not less than 48 hours by a qualified independent testing laboratory acceptable to the administrative authority.
- C. CPVC: Chlorinated polyvinyl chloride (CPVC) pipe together with recommended fittings must be tested by the manufacturer at 150 psi and 210 °F for a period of not less than 48 hours by a qualified independent testing laboratory acceptable to the administrative authority.
- D. PEX: Cross-linked polyethylene (PEX) tubing systems together with recommended fittings must be tested by the manufacturer at 150 psi and 210 °F for a period of not less than 30 days by a qualified independent testing laboratory acceptable to the administrative authority.
- E. PP-R: Polypropylene (PP-R) pipe together with recommended fittings must be tested by the manufacturer at 540 psi hoop stress and 203 °F for a period of not less than 40 days by a qualified independent testing laboratory acceptable to the administrative authority.
- F. Lead-free: All fittings, valves, fixtures, and accessories that contact potable water shall be lead-free compliant per NSF 61 and NSF 372.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
 1. PP-R Installer: Shall be factory-trained and carry proof of training during Inspections.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. 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. Polypropylene-Random Piping:
 - 1. Furnish ten-year manufacturer warranty for piping, fittings, and any incidental damage caused by material failure from manufacturer defect.
 - 2. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or workmanship.
 - 3. Manufacturer's pressure testing procedure shall be followed to validate the warranty.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tubing (2-inch diameter and smaller): ASTM B88, Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 °F.
 - 3. Joints: Push-fit complying with NSF 61 and ASSE 1061. Crimping tool approved by Manufacturer and local Authority Having Jurisdiction. For pipe sizes 3/8 to 2 inches only.
- B. Steel Pipe (2-½-inch diameter and larger): ASTM A53/A53M Schedule 40, galvanized, cut grooved ends. Note rolled grooved ends not permitted for galvanized steel pipe per Minnesota Plumbing Code Chapter 4714.
 - 1. Manufacturers:
 - a. Victaulic.
 - b. Anvil.
 - 2. Fittings: Grooved ends.
 - 3. Joints: Grooved mechanical couplings meeting ASTM F1476.
 - a. Manufacturers:
 - 1) Victaulic.
 - 2) Anvil Gruvlok.
 - 3) Grinnell.
- C. Polypropylene-Random (PP-R)
 - 1. Manufacturers:
 - a. Niron (Nupi Americas, Inc.).
 - b. Uponor.
 - 2. Pipe: ASTM F2389, NSF 14, and NSF 61, three-layer extrusion, including fiber layer (faser).
 - 3. Fittings: ASTM F2389, NSF 14, and NSF 61, PP-R.
 - 4. Joints: Fusion-weld, including socket-fusion, electrofusion, or butt-fusion.
 - 5. Valves: ASTM F2389, NSF 14, and NSF 61, PP-R.
 - 6. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
 - a. Flame Spread Classification: Less than 25.
 - b. Smoke Development Rating: Less than 50.
 - 7. UV Protection: Pipe to be exposed to directly sunlight for more than 30 days shall be provided with a Factory applied, UV-resistant coating, or alternative UV protection.
 - 8. Integral Thermal and Vapor Barrier: ASTM E84, UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.

- a. Up to 1 inch of required insulation: Factory-installed, thermal and vapor barrier insulation shall be provided.
 - b. Over 1 inch of required insulation: Additional overlap of factory-installed, thermal and vapor barrier insulation shall be provided.
 - c. Thick-wall, self-insulating fittings: Do not require an additional vapor barrier.
 - d. See Section 22 07 00 for insulation requirements.
- D. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M, NSF 14, FHA Bulletin 76, chlorinated polyvinyl chloride (CPVC) material.
 - 1. Pipe Sizes 2-½-Inches to 6 Inches: Schedule 80.
 - 2. Fittings: ASTM D2846/D2846M or ASTM F441/F441M, CPVC.
 - 3. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.
 - 4. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
 - a. Flame Spread Classification: Less than 25.
 - b. Smoke Development Rating: Less than 50.
- E. Cross-linked Polyethylene (PEX) Tubing: ASTM F876, ASTM F877, NSF 14, NSF 61.
 - 1. Fittings: ASTM F1807, ASTM F1960, ASTM F2080, ASTM F2098-1, ASTM F2159, ASTM F877. No buried fittings allowed.
 - 2. When installed as a system in accordance with ASTM F877, the system tubing and fittings must be of the same manufacturer and marked as required.
 - 3. When not installed as a system, the fittings must be marked with ASTM F1807, ASTM F1960, ASTM F2080, ASTM F2098-1, or ASTM F215. The tubing must list the fitting and tubing standard.
 - 4. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
 - a. Flame Spread Classification: Less than 25.
 - b. Smoke Development Rating: Less than 50.

2.2 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
 - 1. Copper Piping: Class 150, bronze unions with soldered.
 - 2. Dielectric Connections: Dielectric union connections are NOT permitted.
 - 3. CPVC Piping: CPVC.
 - 4. PP-R Piping: PP-R.
 - 5. PEX Piping: PEX.
- B. Flanges for Pipe 2-½-inches and Larger:
 - 1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 - 2. PVC Piping: PVC flanges.
 - 3. CPVC Piping: CPVC flanges.
 - 4. PP-R Piping: PP-R flanges.
 - 5. 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.

2.3 DIELECTRIC FITTINGS

- A. Dielectric Waterway Connectors:
 - 1. Manufacturers:
 - a. ClearFlow (Elstel Perfection)
 - 2. Dissimilar metals shall be separated with a dielectric waterway connector
 - 3. Material: Electro-zinc-plated steel casing, insert plastic lining, threaded ends.

2.4 BALL VALVES

- A. Manufacturers:
 - 1. Crane Valve, North America.
 - 2. Hammond Valve.
 - 3. Milwaukee Valve Company.
 - 4. NIBCO, Inc.
 - 5. Stockham Valves & Fittings.
- B. 2 inches and Smaller: MSS SP 110, one-piece bronze body, chrome plated brass ball, regular port, Teflon seats, blowout proof stem, solder or threaded ends with lever handle.
 - 1. PEX Applications: Ends may be compatible with approve fitting system.

2.5 BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Crane Valve, North America.
 - 2. Hammond Valve.
 - 3. Milwaukee Valve Company.
 - 4. NIBCO, Inc..
 - 5. Stockham Valves & Fittings.
- B. 2-½-inches and Larger: MSS SP 67, Class 150.
 - 1. Body: Cast or ductile iron, wafer lug or grooved ends, stainless steel stem, extended neck.
 - 2. Disc: Nickel-plated ductile iron.
 - 3. Seat: Resilient replaceable EPDM.
 - 4. Handle and Operator: 10 position lever handle.
- C. CPVC: 2 inches through 10 inches: 150 psi at 73 °F water temperature, maximum service temperature 210 °F, one- or two-piece body, ASTM D1784 CPVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.

2.6 CHECK VALVES

- A. Horizontal Swing Check Valves:
 - 1. Manufacturers:
 - a. Crane Valve, North America.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO, Inc.
 - e. Stockham Valves & Fittings.
 - 2. 2 inches and Smaller: MSS SP 80, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
 - 3. 2-½-inches and Larger: MSS SP 71, cast iron body, bolted cap, bronze or cast iron disc, flanged ends.

2.7 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29.

2.8 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Ashcroft, Inc.
 - 2. H. O. Trerice Company.
 - 3. Weiss Instruments, Inc.
- 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, Length as required for proper fluid sensing.
 4. Accuracy: 2 percent.
 5. Calibration: Both °F and °C.
 6. Range:
 - a. Hot Water: 30 °F to 160 °F.
 - b. Cold Water: 0 °F to 100 °F.
- C. Light-Powered Digital Thermometer: NEMA-4X, adjustable angle, LCD digits display, cast aluminum case with epoxy finish, cast aluminum adjustable joint with positive locking device.
1. Size: 7 inch scale.
 2. Window: Clear Lexan.
 3. Stem: Brass, 3/4 inch NPT, Length as required for proper fluid sensing.
 4. Accuracy: 1 percent.
 5. Units of Measure: Both °F and °C.
 6. Range:
 - a. Hot Water: 30°F to 160°F.
 - b. Cold Water: 0°F to 100°F.

2.9 FLOW CONTROL/BALANCING VALVES - AUTOMATIC

- A. Manufacturers:
1. Bell & Gossett (Xylem, Inc).
 2. Danfoss.
 3. Griswold Controls.
 4. Taco, Inc.
 5. Victaulic Co.
 6. ThermOmegaTech.
- B. Type: Flow control valve shall be manual balancing valve or automatic thermostatic recirculation valve (TRV), Circuit Solver Model CSUA by ThermOmegaTech, or equal.
- C. Construction: Brass, bronze, or stainless-steel body with union and isolation ball valve on inlet and outlet, and temperature and pressure test plugs.
- D. Calibration: When fully closed the TRV shall bypass a minimum of 0.1 GPM to maintain dynamic control of the hot water recirculation loop. Fully open TRV shall modulate towards a minimum closed position upon sensing a water temperature 3 °F or more above setpoint.
- E. Automatic Control Mechanism: TRV shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure. Thermal actuator shall be spring operated and self-cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits. Thermal actuator shall be rated for a minimum of 200,000 cycles. Thermal actuator shall be factory adjustable from 105 °F to 140 °F as required by project conditions.
- F. Accessories: Valve shall include internal/integrated check valve.

2.10 RELIEF VALVES

- A. Pressure Relief:
1. ANSI Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 °F, capacity ASME certified and labeled.

2.11 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Apollo Valves (Aalberts Industries N.V.)
 - 2. Watts Water Technologies, Inc.
 - 3. Zurn Wilkins (Zurn Industries, LLC).
- B. Reduced Pressure Backflow Preventers:
 - 1. Comply with ASSE 1013.
 - 2. Bronze body, with bronze internal parts and stainless-steel springs.
 - 3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
- C. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent.

2.12 WATER HAMMER ARRESTORS

- A. ASSE 1010; copper construction, piston type sized in accordance with PDI WH-201.
- B. Pre-charged suitable for operation in temperature range 34 to 250 °F and maximum 150 psi working pressure.

2.13 THERMOSTATIC MIXING VALVES

- A. Thermostatic Mixing Valve, Exposed Point of Use:
 - 1. Basis of Design: Leonard, Model: 170A-LF
 - 2. Manufacturers:
 - a. Leonard Valve Company.
 - b. Lawler Manufacturing Co., Inc.
 - 3. Performance:
 - a. Mixing Temperature Setpoint: Refer to Drawings.
 - b. Minimum Flow: .25 GPM Certified to ASSE.
 - c. Maximum Flow: 4.0 GPM
 - d. Maximum Operating Pressure: 125 PSI
 - e. Maximum Hot Water Temperature: 180°F.
 - 4. Construction:
 - a. 3/8" inlet and 3/8" outlet connections
 - b. Integral check stops to prevent cross flow with screens to prevent debris from passing through.
 - c. All components be from corrosion resistant materials.
 - d. Adjustable temperature control from 95°F - 120°F.
 - e. Include locking temperature regulator to prevent accidental movement.
 - f. Include mounting bracket.
 - 5. Finish:
 - a. Rough finish.
 - b. Chrome plated options.
 - 6. Shall have optional cold-water bypass.
 - 7. Compliance:
 - a. ASSE 1070.
 - b. Low-lead compliant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. 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.

3.3 INSTALLATION - THERMOMETERS AND GAGES

- A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-½-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 gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- D. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.4 INSTALLATION - HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29

3.5 INSTALLATION - ABOVE GROUND PIPING

- A. For non-metallic pipe, verify nominal pipe size of equivalent pressure drop, flow rate, and velocity.
- B. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- E. Group piping whenever practical at common elevations.
- F. Slope piping and arrange systems to drain at low points.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- I. Provide access where valves and fittings are not accessible.
- 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. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.
- M. Install domestic water piping in accordance with ASME B31.9.
- N. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
 - 1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.
- O. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.
 - P. Install unions downstream of valves and at equipment or apparatus connections.
 - Q. Install valves with stems upright or horizontal, not inverted.
 - R. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
 - S. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
 - T. Install butterfly valves for throttling, bypass, or manual flow control services.
 - U. Provide check valves on discharge of water pumps.
 - V. Provide flow controls in water circulating systems as indicated on Drawings.
 - W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur: on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
 - X. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
 - Y. Install water hammer arrestors complete with isolation valve.
 1. Water hammer arrestor and isolation valve shall be installed in accessible locations.
 - a. Walls and hard ceilings are not considered accessible locations.
 2. Refer to Drawings for water hammer arrestor locations.
 - Z. Water supply connections to fixtures or equipment which have inlets below the spill line, must be provided with an approved backflow preventer.
 - AA. Valves shall be installed permitting the water supply to each individual fixture to be shut off without disrupting any other portion of the building. An accessible control valve shall be installed ahead of each slip joint connection at a plumbing fixture.
 - BB. Lead-free: all fittings, valves, and fixtures and accessories that contact potable water shall be lead-free compliant per NSF 61 and NSF 372.
 - CC. Where two separate handles control the hot and cold water, the left-handed control of the faucet where facing the fixture fitting outlet shall control the hot water. Faucets and diverter shall be connected to the water distribution system so that hot water corresponds to the left side of the fittings.
 - DD. The installation of reduced pressure zone assemblies, double check valve assemblies, pressure vacuum breakers, spill-proof vacuum breakers, reduced pressure detector fire protection assemblies, or double check detector fire protection assemblies is permitted only when a testing and inspection program acceptable to the administrative authority is provided (see Minnesota rules, chapter 4714, section 603.5.23). The administrative authority and water purveyor must be notified prior to installation. Devices must be tested upon initial installation and not less than annually, and records must be kept. Installations must be at least 12-inches and not more than 5-feet above finished floor or ground level unless a permanent platform for access is provided.
 - EE. Wall hydrants must meet ASSE Standard 1019. Where permitted by the administrative authority, wall hydrants may utilize non-removable ASSE 1052 backflow preventers or non-removable ASSE 1011 vacuum breakers and provision is made to protect from freezing (see Minnesota Rules, Chapter 4714, Sections 603.5.7, 312.6, and 301.1.2).
 - FF. Water heaters must be accessible with sufficient clearance for maintenance and repair. Unlisted water heaters must have 12-inches minimum clearance on all sides (see Minnesota Rules, Chapter 4714, Sections 507.26 and 504.3.2).

- GG. The water softener should have a bypass valve permitting equipment service or removal without shutting off the water service completely.

3.6 INSTALLATION – CPVC SYSTEMS

- A. CPVC: Installation must be in accordance with IAPMO 20-98; however, this material may be air tested.
- B. Install U-bend type pipe expansion loops every 50 feet. Minimum U-bend dimensions shall be 22 inches by 11 inches by 22 inches. Install guides per CPVC system manufacturer's installation requirements.

3.7 INSTALLATION – PEX SYSTEMS

- A. PEX: Shall be installed by a factory-trained installer in accordance with the manufacturer's installation instructions.

3.8 INSTALLATION – PP-R SYSTEMS

- A. PP-R: Shall be installed by a factory-trained installer in accordance with the manufacturer's installation instructions.
- B. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
- C. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
- D. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F2389 and the manufacturer's specifications.
- E. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

3.9 FIELD QUALITY CONTROL

- A. Test domestic water piping system in accordance with local Authority Having Jurisdiction.
- B. PP-R: Test piping system in accordance with the Manufacturer's standard testing procedure.

3.10 CLEANING

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. 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).
- C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
- H. 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 22 13 00 – FACILITY SANITARY SEWERAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary sewer piping below grade.
 - 2. Sanitary sewer piping above grade.
 - 3. Pipe hangers and supports.
 - 4. Floor drains.
 - 5. Cleanouts.
- B. Related Sections:
 - 1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
 - 2. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
 - 3. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
 - 4. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
 - 5. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Execution requirements for pipe expansion devices for placement by this section.
 - 6. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A112.6.3 - Floor Drains and Trench Drains.
 - 2. ASME A112.14.1 - Backwater Valves.
 - 3. ASME A112.14.3 - Grease Interceptors.
 - 4. ASME A112.14.4 - Grease Removal Devices.
 - 5. ASME A112.36.2M - Cleanouts.
- B. ASTM International:
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 - 3. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
 - 4. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 5. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - 6. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- C. 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. Product Data:

22 1300 - 1
JLG 250238

Tech Single User Restroom Remodeling
Facility Sanitary Sewerage

1. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of equipment and clean-outs.

1.5 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. 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. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BELOW GRADE

- A. Cast Iron Pipe: CISPI 301, ASTM A888, hub-less, service weight.
 1. Fittings: Cast iron, CISPI 301.
 2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.
- B. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
 1. Fittings: PVC, ASTM D2665.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, ASTM A888, hub-less, service weight.
 1. Fittings: Cast iron, CISPI 301.
 2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.
- B. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
 1. Fittings: ASTM D2665, PVC.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29.

2.4 FLOOR DRAINS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Co.
 2. Josam Co.

3. MIFAB, Inc.
 4. Sioux Chief Manufacturing Co.
 5. Watts Water Technologies Co.
 6. Zurn Industries, LLC.
- A. Floor Drain (FD-1): ASME A112.21.1; round strainer, cast iron floor drain with nickel bronze grate (adjustable).

2.5 CLEANOUTS

1. Jay R. Smith Manufacturing Co.
 2. Josam Co.
 3. MIFAB, Inc.
 4. Sioux Chief Manufacturing Co.
 5. Watts Water Technologies Co.
 6. Zurn Industries, LLC.
- B. Exterior Surfaced Areas: Epoxy coated cast iron access housing with anchor flanges and extra heavy-duty ductile iron cover.
- C. Exterior Unsurfaced Areas (Yard Cleanout): PVC threaded tee.
- D. Interior Finished Floor Areas: Epoxy coated cast iron floor cleanout with 5-inch round adjustable gasketed nickel bronze top, stainless steel carpet marker, removable gas tight gasketed brass cleanout plug, and no hub outlet.
- E. Interior Finished Wall Areas: Epoxy coated cast iron floor cleanout with 5-inch round adjustable gasketed heavy-duty stainless-steel top, removable gas tight gasketed brass plug, and no hub outlet.
- F. Interior Finished Floor Areas: epoxy coated cast iron floor cleanout with 5-inch x 5-inch square adjustable gasketed heavy-duty stainless-steel top, removable gas tight gasketed brass plug, and no hub outlet.
- G. Interior Finished Wall Areas: wall cleanout with two-piece expandable cleanout plug, stainless steel access cover, and vandal proof stainless steel screw.
- H. Interior Unfinished Accessible Areas: Cast iron stack cleanout with threaded brass raised head cleanout plug, and no hub connections.

PART 3 EXECUTION

3.1 EXAMINATION

- A. 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.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify existing piping system connection size, location, and invert is as indicated on Drawings.

- B. Establish invert elevations, sloped for drainage to ¼-inch per foot minimum of buried piping with not less than 2 ft of cover. Maintain gradients.
- C. Establish minimum separation of drainage piping from other services piping in accordance with local code.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Excavate pipe trench in accordance with Division 31.
- F. Install pipe to elevation required to maintain slope.
- G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth.
- H. Install pipe on prepared bedding.
- I. Route pipe in straight line.
- J. Install trace wire continuous buried 6 inches below finish grade, above pipeline; coordinate with Division 31.
- K. All horizontal branch drains shall be uniformly pitched at ¼-inch per foot.
- L. The building sewer must be installed with a uniform slope of at least ¼-inch per foot. Where municipal sewer depth, structural features, or building arrangement preclude this slope, a slope of 1/8-inch per foot minimum may be utilized if approved by the authority having jurisdiction.
- M. All sinks, except for lavatories and private-use bar sinks, must be provided with 2-inch minimum vertical fixture drains. Laundry tubs, domestic clothes washers, and urinals also require 2-inch minimum vertical drains.
- N. 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 6 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.

3.5 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to ¼-inch per foot minimum. Maintain gradients.
- 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. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Do not spread piping, conserve 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. Refer to Section 23 05 16.

- J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
- K. Provide access where valves and fittings are not accessible.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.
- O. Install bell and spigot pipe with bell end upstream.
- P. Sleeve pipes passing through partitions, walls, and floors.
 - 1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
 - 2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.
- Q. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.
- R. Support cast iron drainage piping at every joint.
- S. Installation standards for ABS and PVC allow the use of offsets, expansion joints, or restraints provided conditions of proper support and movement are met. Accordingly, aboveground horizontal and vertical plastic piping must be installed with restraint fittings or a minimum 24-inch, 45-degree offset every 30 feet.

3.6 FIELD QUALITY CONTROL

- A. Cast iron soil pipe and fittings must be marked with their country of origin, the collective trademark of the Cast Iron Soil Pipe Institute, and identification of the original manufacturer in addition to markings required by reference standards (See Minnesota Rules, Chapter 4714, Section 701.0). They shall also be listed by NSF International.
- B. Test sanitary waste and vent piping system in accordance with local Authority Having Jurisdiction.

END OF SECTION

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SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Lavatories.
- B. Related Sections:
 - 1. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
 - 2. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- B. 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 Supply Fittings.
 - 3. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.
 - 4. ASME A112.19.2 - Ceramic Plumbing Fixtures.
 - 5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.
 - 6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
 - 7. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
- C. NSF International:
 - 1. NSF 61 – Drinking Water System Components – Health Effects.
 - 2. NSF 372 – Drinking Water Components – Lead Content.

1.3 SUBMITTALS

- A. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit fixture, trim, exploded view, and replacement parts lists.

1.5 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Provide products requiring electrical connections listed and classified by testing firm acceptable to Authority Having Jurisdiction as suitable for purpose specified and indicated.
- C. Lead-free: All fittings, valves, fixtures, and accessories that contact potable water shall be lead-free compliant per NSF 61 and NSF 372.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.1 FLUSH-VALVE WATER CLOSETS

- A. Manufacturers:
 - 1. Kohler Co.
 - 2. American Standard.
 - 3. Mansfield.
 - 4. ProFlo.
 - 5. Toto USA.
 - 6. Sterling.
 - 7. Zurn.
 - 8. Sloan.

2.2 LAVATORIES

- A. Manufacturers:
 - 1. Kohler.
 - 2. American Standard.
 - 3. ProFlo.
 - 4. Sterling.
 - 5. Zurn.
 - 6. Elkay.
 - 7. Sloan.
 - 8. Delta.

2.3 LAVATORY INSULATION KIT

- A. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.4 GENERAL REQUIREMENTS

- A. Refer to plumbing fixture schedule on Drawings for basis of design requirements. Verify plumbing fixtures with architect and general contractor prior to ordering.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify electric power is available and of correct characteristics.
- C. 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 INSTALLATION

- A. Install Work in accordance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall supports or wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified, color to match fixture.

3.4 INSTALLATION – WATER CLOSETS

- A. Solidly attach water closets to floor with lag screws. Flashing is not intended hold fixture in-place.
- B. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.6 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.7 CLEANING

- A. Clean plumbing fixtures and equipment.

3.8 PROTECTION OF FINISHED WORK

- A. Do not permit use of fixtures before final acceptance.

3.9 SCHEDULES

- A. Fixture Mounting Heights: Refer to Architectural Drawings and Specifications.
- B. Fixture Rough-In: Refer to Drawings.

END OF SECTION

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SECTION 23 05 13 - COMMON MOTOR REQ'TS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes single- and three-phase motors for application on equipment provided under other sections.
- B. Related Sections:
 - 1. NONE

1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- C. International Electrical Testing Association:
 - 1. NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.
- B. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.
- C. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

- A. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
 - 1. Voltage: As indicated on Drawings.
 - 2. Service Factor: 1.15 or as provided by equipment manufacturer.
 - 3. Enclosure: Meet conditions of installation.
 - 4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 - 5. Insulation System: NEMA Class F for chillers, class B for pumps, fans, and other equipment.

6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
 7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid-state control relay with wiring to terminal box.
 8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Stamp bearing sizes on nameplate.
 9. Sound Power Levels: Conform to NEMA MG 1.
- B. Single Phase Motors:
1. Electronically commutated (EC) type where available, otherwise use permanent split-capacitor (PSC) type motor.
 2. Voltage: As indicated on Drawings, single phase, 60 Hz.
- C. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 SOURCE QUALITY CONTROL

- A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned motors.
- B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

- A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- B. Install engraved plastic nameplates in accordance with Division 26.
- C. Ground and bond motors in accordance with Division 26.

3.3 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION

SECTION 23 05 29 – HANGERS & SUPPORTS FOR HVAC PIPING AND EQUIP.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Hanger rods.
 - 3. Inserts.
 - 4. Flashing.
 - 5. Equipment curbs.
 - 6. Sleeves.
 - 7. Mechanical sleeve seals.
 - 8. Formed steel channel.
 - 9. Firestopping relating to HVAC work.
 - 10. Firestopping accessories.
 - 11. Equipment bases and supports.
- B. Related Sections:
 - 1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product and execution requirements for hanger and firestopping accessories.
 - 2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.
 - 3. Section 23 21 13 - 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 B31.1 - Power Piping.
 - 2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
 - 3. ASME B31.9 - Building Services Piping.
- B. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Method for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Standard Test Method of Fire Tests of Penetration Firestop Systems.
 - 4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- C. American Welding Society:
 - 1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- D. FM Global:
 - 1. FM Approvals - Approval Guide.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design Manufacturer, Selection, Application, and Installation.
 - 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 - Standard for Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Standard for Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops.
 - 4. UL Directory – Certifications Directory - Fire-Resistance-Rated Systems and Products.

- G. Intertek Testing Services (Warnock Hersey Mark):
 - 1. WH Directory - Warnock Hersey (WH) Mark Directory.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

- A. NONE.

1.5 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with AWS D1.1/D1.1M for welding hanger and support attachments to building structure.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Anvil International (Mueller Water Products, Inc.).
 - 2. Carpenter & Paterson Inc.
 - 3. Creative Systems Inc.
 - 4. Flex-Weld, Inc.
 - 5. Globe Pipe Hanger Products Inc.
 - 6. Michigan Hanger Co.
 - 7. Superior Valve Co.
- B. Hydronic Piping:
 - 1. Conform to MSS SP-69.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable, clevis.
 - 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 - 5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
 - 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
 - 8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
 - 9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.

10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, carbon steel ring.
16. Plastic Pipe Support: rubber-lined or felt-lined clamps. Tape-lined on non-clamping hangers.

2.2 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Refer to Section 22 05 29.

2.4 FLASHING

- A. Refer to Division 07

2.5 EQUIPMENT CURBS

- A. Fabrication: Welded 18-gauge galvanized steel shell and base, mitered 3-inch cant, variable step to match roof insulation, factory installed wood nailer.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick or Schedule 40 galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Walls: Steel pipe or 18 gage or Schedule 40 thick galvanized steel.
- C. Sleeves for Pipes Through Beams and Footings: Steel pipe or 18 gage or Schedule 40 thick galvanized steel.
- D. Sleeves for Round Ductwork: Galvanized steel.
- E. Sleeves for Rectangular Ductwork: Galvanized steel.
- F. Sealant: Acrylic.

2.7 MECHANICAL SLEEVE SEALS

- A. Refer to Section 22 05 29.

2.8 FORMED STEEL CHANNEL

- A. Refer to Section 22 05 29.

2.9 FIRESTOPPING

- A. Refer to Division 07.

2.10 FIRESTOPPING ACCESSORIES

- A. Refer to Division 07.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

- A. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

- A. Refer to Section 22 05 29 for installation requirements.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Refer to Section 22 05 29 for installation requirements.
- B. Support piping as per Schedule included in this Section.

3.5 INSTALLATION - FLASHING

- A. Refer to Division 07.

3.6 INSTALLATION - SLEEVES

- A. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- B. Refer to Section 22 05 29 for additional installation requirements.

3.7 INSTALLATION - FIRESTOPPING

- A. Install firestopping material at fire and smoke-rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items that require firestopping.
- B. Refer to Division 07.

3.8 PROTECTION OF FINISHED WORK

- A. Protect adjacent surfaces from damage by material installation.

3.9 SCHEDULES

- A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HORIZONTAL SPACING Feet	MAXIMUM SPACING Feet	VERTICAL
ABS pipe	4	10 (note 2)	
Aluminum pipe and tubing	10	15	
Brass pipe	10	10	
Brass tubing, 1-1/4-inch diameter and smaller	6	10	
Brass tubing, 1-1/2-inch diameter and larger	10	10	
Cast-iron pipe	5 (note 1)	15	
Copper or copper-alloy pipe	12	10	

Copper or copper-alloy tubing, 1-1/4-inch diameter and smaller	6	10
Copper or copper-alloy tubing, 1-1/2-inch diameter and larger	10	10
CPVC pipe or tubing, 1 inch and smaller	3	10 (note 2)
CPVC pipe or tubing, 1-1/4-inch and larger	4	10 (note 2)
Lead pipe	Continuous	4
PB pipe or tubing	32 inches	4
PEX tubing	32 inches	10 (note 2)
Polypropylene (PP) pipe or tubing, 1 inch or smaller	32 inches (note 3)	10 (note 2)
Polypropylene (PP) pipe or tubing, 1-1/4-inch or larger	4 (note 3)	10 (note 2)
PVC pipe	4	10
Steel tubing	8	10
Steel pipe	12	15

- B. Note 1: The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.
- C. Note 2: Mid-story guide (sliding point) required.
- D. Note 3: Hanger spacing may be increased per piping manufacturer's installation instructions.

END OF SECTION

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SECTION 23 05 48 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vibration isolators.
 - 2. Acoustic housings.
- B. Related Sections:
 - 1. Section 21 05 00 – Common Work Results for Fire Suppression: Product requirements for pipe hangers and supports.
 - 2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports.
 - 3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
 - 4. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
 - 5. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- B. American National Standards Institute:
 - 1. ANSI S1.4 - American National Standard Specification for Sound Level Meters.
 - 2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
 - 3. ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
 - 4. ANSI S12.60 – American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools.
- C. Air Conditioning, Heating, & Refrigeration Institute:
 - 1. AHRI 575 - Method of Measuring Machinery Sound Within an Equipment Space.
- D. American Society of Heating, Refrigerating and:
 - 1. ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
 - 2. ASHRAE Handbook - HVAC Applications.
- E. ASTM International:
 - 1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
 - 3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.
- F. International Organization for Standardization:
 - 1. ISO 3747 - Determination of Sound Power Levels and Sound Energy Levels of Noise Sources Using Sound Pressure - Engineering/Survey Methods for use in Situ in a Reverberant Environment.
- G. Sheet Metal and Air Conditioning Contractors':
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.
- B. Provide minimum static deflection of isolators for equipment per Vibration Isolation Schedule at end of Section.
- C. Consider upper floor locations critical unless otherwise indicated.
- D. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.
- E. Maintain rooms at following maximum sound levels, in Room Criteria (RC) as defined by ASHRAE Handbook., HVAC Applications and ANSI S1.8. See Room Sound Level Schedule at end of Section.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of hangers including attachment points.

1.7 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with [ANSI S1.13](#) and [AHRI 575](#) standards and recommendations of ASHRAE 68.
- C. School Buildings: Perform Work in accordance with ANSI S12.60 standard.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Selection:
 - 1. Specific equipment isolator and deflection requirements per Isolator Schedule at the end of this Section.
- B. Neoprene Pad Isolators (Type 1):
 - 1. Rubber or neoprene-waffle pads.
 - a. 30 durometer minimum.
 - b. Minimum 1/2 inch thick.
 - c. Maximum loading 40 psi.
 - d. Height of ribs: not to exceed 0.7 times width.
 - 2. Configuration: Single layer or 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.
- C. Glass Fiber Pads (Type 1): Neoprene jacketed pre-compressed molded glass fiber.

- D. Rubber Mount or Hanger (Type 2): Molded rubber with threaded insert.
- E. Open Spring Isolators (Type 3):
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25-inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- F. Closed Spring Isolators (Type 3):
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance.
- G. Spring Hanger (Type 3):
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators or rubber hanger with threaded insert.
 - 4. Misalignment: Capable of 20-degree hanger rod misalignment.
- H. Restrained Spring Isolators (Type 4):
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25-inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 5. Restraint: Furnish mounting frame and limit stops.
- I. Restrained Closed Spring Isolators (Type 4):
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance and limit stops.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 EXISTING WORK

- A. Provide access to existing piping and ductwork and other installations remaining active and requiring access.
- B. Extend existing piping and ductwork installations using materials and methods.

3.3 INSTALLATION – VIBRATION ISOLATION

- A. Install isolation for motor driven equipment.
- B. Adjust equipment level.
- C. Install spring hangers without binding.
- D. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- F. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.
- G. Support piping connections to isolated equipment resiliently as follows:
 1. Suspended piping: All piping in mechanical rooms and within 50 feet of vibration-isolated equipment.
 2. Select three hangers closest to vibration source for minimum static deflection equivalent to isolated equipment deflection, with a 2-inch maximum. Select remaining isolators for minimum 0.75-inch static deflection.
 3. Suspended piping: Suspended below or within 50 feet of noise-sensitive areas.
- H. Piping over 2-inch diameter suspended below or within 50 feet of noise-sensitive areas shall be hung with isolation hangers.

3.4 INSTALLATION – ACOUSTICAL PERFORMANCE

- A. School Buildings: Perform Work in accordance with ANSI S12.60 standard.

3.5 SCHEDULES

- A. Room Sound Level:

Room Types	Description	Noise/Room Criterion (NC/RC)
Performing Arts Spaces	Drama theaters, concert and recital halls	20
	Music teaching studios	25
	Music practice rooms	30

Room Types	Description	Noise/Room Criterion (NC/RC)
Schools	Classrooms – K-8	30
	Classrooms – secondary and post-secondary	30
	Large lecture rooms with speech amplification	30
	Large lecture rooms without speech amplification	25
Libraries		30

B. Pipe Isolation Schedule:

Pipe Size Inch	Isolated Distance from Equipment diameters
1	120
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters

C. Equipment Isolation Schedule:

Isolated Equipment	Slab on Grade		Floor Span Up to 20 ft		Floor Span 20 to 30 ft		Floor Span 30 to 40 ft	
	Base & Isolator Type ¹	Min. Defl. (In.)	Base & Isolator Type ¹	Min. Defl. (In.)	Base & Isolator Type ¹	Min. Defl. (In.)	Base & Isolator Type ¹	Min. Defl. (In.)
Axial Fans, Plenum Fans, Cabinet Fans, Fan Sections, Centrifugal Inline Fans								
≤ 22-inch diameter	A-2	0.25	A-3	0.75	A-3	0.75	C-3	0.75
≥ 24-inch diameter, ≤ 2-in. SP HP, ≤ 300 RPM	B-3	2.50	C-3	3.50	C-3	3.50	C-3	3.50
≥ 24-inch diameter, ≤ 2-in. SP, 301 to 500 RPM	B-3	0.75	B-3	1.50	C-3	2.50	C-3	2.50
≥ 24-inch diameter, ≤ 2-in. SP HP, ≥ 500 RPM	B-3	0.75	B-3	1.50	B-3	2.50	B-3	2.50
≥ 24-inch diameter, > 2-in. SP, ≤ 300 RPM	C-3	2.50	C-3	3.50	C-3	3.50	C-3	3.50
≥ 24-inch diameter, > 2-in. SP, 301 to 500 RPM	C-3	1.50	C-3	1.50	C-3	2.50	C-3	2.50
≥ 24-inch diameter, > 2-in. SP, ≥ 500 RPM	C-3	0.75	C-3	1.50	C-3	1.50	C-3	2.50
Centrifugal Fans								
≤ 22-inch diameter	B-2	0.25	B-3	0.75	B-3	0.75	B-3	1.50

Isolated Equipment	Slab on Grade		Floor Span Up to 20 ft		Floor Span 20 to 30 ft		Floor Span 30 to 40 ft	
	Base & Isolator Type ¹	Min. Defl. (In.)	Base & Isolator Type ¹	Min. Defl. (In.)	Base & Isolator Type ¹	Min. Defl. (In.)	Base & Isolator Type ¹	Min. Defl. (In.)
≥ 24-inch diameter, ≤ 40 HP, ≤ 300 RPM	B-3	2.50	B-3	3.50	B-3	3.50	B-3	3.50
≥ 24-inch diameter, ≤ 40 HP, 301 to 500 RPM	B-3	0.75	B-3	1.50	B-3	2.50	B-3	2.50
≥ 24-inch diameter, ≤ 40 HP, ≥ 500 RPM	B-3	0.75	B-3	0.75	B-3	0.75	B-3	1.50
≥ 24-inch diameter, ≥ 50 HP, ≤ 300 RPM	C-3	2.50	C-3	3.50	C-3	3.50	C-3	3.50
≥ 24-inch diameter, ≥ 50 HP, 301 to 500 RPM	C-3	1.50	C-3	1.50	C-3	2.50	C-3	2.50
≥ 24-inch diameter, ≥ 50 HP, ≥ 500 RPM	C-3	1.00	C-3	1.50	C-3	1.50	C-3	2.50

Note 1: Base type and isolator type correspond with equipment listed in Part 2 of this Section.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Stencils.
 - 4. Pipe markers.
 - 5. Ceiling tacks.
 - 6. Labels.
 - 7. Lockout devices.
- B. Related Sections:
 - 1. NONE.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

- A. NONE.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

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 square.
- B. Metal Tags:
 1. Brass, Aluminum, or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches square 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 in anodized aluminum or plastic laminated frame.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
 2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
 3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
 4. Ductwork and Equipment: 1-3/4 inches high letters.
- B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PLASTIC MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Markers:
 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Markers:
 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Markers:
 1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

- A. Description: Steel or plastic with 3/4 inch diameter color-coded head.
- B. Color code as approved by Owner. If no preference by Owner, color as follows:
 1. HVAC equipment (including terminal boxes): Yellow.
 2. Fire dampers/smoke dampers: Red.
 3. Plumbing valves: Green.
 4. Heating/cooling valves: Blue.
- C. Contractor Option: Adhesive stickers may be used in lieu of tacks.

2.6 LABELS

- A. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

- A. Lockout Hasps:
 1. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.
- B. Valve Lockout Devices:

1. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units, zone dampers, and radiator valves with numbered tags corresponding to Drawings.
- J. Identify space temperature sensors with tags indicating HVAC unit and air terminal unit (if applicable) served.
- K. Tag automatic controls, instruments, and relays. Key to control schematic.
- L. Identify piping, concealed or exposed, with plastic markers, or plastic tape markers.
 1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
 3. Locate identification:
 - a. Not to exceed 20 feet on straight runs including risers and drops.
 - b. Adjacent to each valve and tee.
 - c. At each side of penetration of structure or enclosure.
 - d. At each obstruction.
- M. Identify ductwork with plastic tape markers.
 1. Identify with air handling unit identification number, area served, and flow direction.
 2. Locate identification:
 - a. At air handling unit.
 - b. At each side of penetration of structure or enclosure.
 - c. At each obstruction.
- N. Provide ceiling tacks to locate valves, dampers, and terminal boxes above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 23 05 93 - 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 23 09 23 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.
 - 2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.2 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC - National Standards for Total System Balance.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 111 - Measurement, Testing, Adjusting and Balancing of Building HVAC Systems.
- C. Natural Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- D. Testing, Adjusting and Balancing Bureau:
 - 1. TABB – International Standards for Environmental Systems Balance.

1.3 SYSTEM DESCRIPTION

- A. The Work in this Section shall be by the Testing and Balancing Contractor (TAB) as a sub-contractor to the Mechanical Contractor. The TAB shall be a third party to the Mechanical Contractor.
- B. Existing Buildings: The Scope of TAB Work is to include any affected systems in the existing building.

1.4 SUBMITTALS

- A. Test Reports: Indicate data on AABC, ASHRAE 111, NEBB, or TABB/SMACNA Report forms.
- B. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- C. Furnish reports in electronic format, .pdf files preferred. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of flow measuring stations, balancing valves, and rough setting.
- B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with AABC, ASHRAE 111, NEBB, or TABB standards.

- C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.7 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC, NEBB, or TABB.
- B. Company shall be third party and independent of Mechanical Contractor.

1.8 SEQUENCING

- A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.9 WARRANTY

- A. Provide warranty for period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.
- B. Warranty shall meet the requirements of the following programs:
 - 1. AABC – National Project Performance Guarantee
 - 2. NEBB – Conformance Certification
 - 3. TABB – International Quality Assurance Program

PART 2 PRODUCTS

2.1 NONE

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to verify required balancing devices are shown and in accessible locations.
- B. Examine approved HVAC system equipment submittals.
- C. 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. Duct systems are clean of debris.
 - 5. Fans are rotating correctly.
 - 6. Access doors are closed and duct end caps are in place.
 - 7. Air outlets are installed and connected.
 - 8. Duct system leakage is minimized.
 - 9. Hydronic systems are flushed, filled, and vented.
 - 10. Pumps are rotating correctly.
 - 11. Proper strainer baskets are clean and in place or in normal position.
 - 12. 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 10 or minus 5 percent of design.

1. Outside air shall NOT be less than the design value.
- B. Air Outlets and Inlets:
 1. Total for Space: Adjust to within plus 10 or minus 5 percent of design.
 2. Each Inlet and Outlet: Adjust to within plus 10 or minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus 10 or minus 5 percent of design.

3.4 ADJUSTING

- A. Verify recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- D. Report defects and deficiencies noted during performance of services, preventing system balance.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- 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. Vary branch air quantities by damper regulation.
 1. Fans with VFDs: Lockout resonant frequencies that generate excessive noise or vibration. Refer to Section 23 05 53.
 2. Belt Driven Fans: Provide sheave drive changes to vary fan speed.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. 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.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries .

- M. Assist Temperature Controls Contractor (TCC) in calibrating flow monitoring stations, variable frequency drives, and static pressure setpoint.
- N. Measure static pressure at the most critical terminal unit and adjust the primary supply air static pressure controller to ensure the minimum static pressure is maintained, as defined by the terminal unit manufacturer.

3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature 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.
- G. Variable Speed Systems:
 - 1. Assist Temperature Controls Contractor (TCC) with establishing the correct pressure control set point.
 - 2. Pumps with VFDs: Lockout resonant frequencies that generate excessive noise or vibration. Refer to Section 23 05 53.

3.7 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Air Coils.
 - 2. Air Handling Units.
 - 3. Fans.
 - 4. 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. Heating Coil Data:
 - 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. Entering water temperature, design and actual
 - i. Leaving water temperature, design and actual
 - j. Entering air temperature, design and actual
 - k. Leaving air temperature, design and actual
 - l. Air pressure drop, design and actual
- 7. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
- 8. 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
- i. Air temperature
- j. Air correction factor
- 9. Terminal Unit Data:
 - a. Manufacturer
 - b. Type, constant, variable, single, dual 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

END OF SECTION

SECTION 23 07 00 – HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Piping system insulation.
 - 2. Equipment insulation.
 - 3. Pipe insulation jackets.
 - 4. Equipment insulation jackets.
 - 5. Insulation accessories including vapor retarders and accessories.
 - 6. Ductwork insulation.
 - 7. Ductwork insulation jackets.
 - 8. Duct liner.
 - 9. Insulation accessories including vapor retarders and accessories.
- B. Related Sections:
 - 1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
 - 2. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for HVAC piping and equipment identification.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
 - 2. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 3. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 4. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - 5. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - 6. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - 7. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 - 8. ASTM E84 – Standard for Test for Surface Burning Characteristics of Building Materials.
 - 9. ASTM E96/E96M - Standard Test Method for Water Vapor Transmission of Materials.
- B. Sheet Metal and Air Conditioning Contractors' National Association:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- C. National Fire Protection Association (NFPA).
- D. Underwriter's Laboratories (UL).
 - 1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- E. 2015 MN Commercial Energy Code.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service, and location.

1.5 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature during and after installation for minimum period as recommended by manufacturer.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Armacell, LLC (Armaflex).
- B. Aeroflex USA, Inc.
- C. K-Flex USA.
- D. Johns Manville.
- E. Knauf Insulation.
- F. Owens-Corning.

2.2 SURFACE BURNING CHARACTERISTICS

- A. For all insulation and related materials, provide UL Classified products per UL 723 and/or meeting ASTM E84, by a testing agency acceptable to the authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
- B. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
- C. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

2.3 PIPE: MAN MADE MINERAL FIBER

- A. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I, 805 degrees F.
- B. Applications on Austenitic stainless steel: Conform to ASTM C795.

- C. Vapor Retarder Jacket:
 - 1. White Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96/E96M; 0.02 perm-inches.
- D. Vapor Retarder Lap Adhesive:
 - 1. Compatible with insulation.

2.4 DUCT: MINERAL FIBER, FLEXIBLE

- A. Insulation: ASTM C553 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications, Type II.
- B. Vapor Retarder Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96/E96M; 0.02 perms.
 - 3. Secure with pressure sensitive tape.
- C. Vapor Retarder Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.

2.5 DUCT: MINERAL FIBER, RIGID

- A. Insulation: ASTM C612 Mineral Fiber Block and Board Insulation, Type IA.
- B. Vapor Retarder Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96/E96M; 0.04 perms.
 - 3. Secure with pressure sensitive tape.
- C. Vapor Retarder Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
- D. Indoor Vapor Retarder Finish:
 - 1. Cloth: Untreated; 9 oz./sq. yd. weight, glass fabric.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.6 JACKETS: PIPE INSULATION AND EQUIPMENT

- A. PVC Plastic Pipe Jacket:
 - 1. Product Description: One-piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 10 mil.
 - 3. Connections: Brush on welding adhesive.
- B. Covering Adhesive Mastic:
 - 1. Compatible with insulation.

2.7 DUCT LINER: ELASTOMERIC CELLULAR FOAM

- A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534/C534M; Type I, Tubular form
- B. Elastomeric Foam Adhesive:
 - 1. Air-dried, contact adhesive, compatible with insulation.

2.8 DUCT LINER: GLASS FIBER

- A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type II.
- B. Adhesive:
 - 1. Waterproof type.

- C. Liner Fasteners: Galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING

- A. Exposed Piping: Locate insulation and cover seams in least visible locations.
- B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, [pump bodies,] and expansion joints.
- C. Manmade mineral fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- E. Manmade mineral fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- F. Inserts and Shields:
 - 1. Application: Piping or Equipment 2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under finish jacket.
 - 4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be site fabricated or factory fabricated.
 - 5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.
- G. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- E. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

- F. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- G. Mineral fiber insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.
- H. Finish insulation at supports, protrusions, and interruptions.
- I. Nameplates and ASME Stamps: Bevel and seal insulation around. Do not insulate over.
- J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 INSTALLATION - DUCTWORK

- A. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder 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.
- B. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor retarder jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- C. External Duct Insulation Application:
 - 1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
 - 2. Secure insulation without vapor retarder 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.
 - 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- D. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 90 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.5 SCHEDULES

- A. Piping:
 - 1. Heating Systems:
 - a. Heating Water Supply and Return:
 - 1) Man Made Mineral Fiber Insulation:
 - a) Pipe Size Range: All.
 - b) Thickness: Per Pipe Insulation Schedule included in this Section.
 - 2. Cooling Systems:
 - a. Condensate Drains from Cooling Coils:
 - 1) Man Made Mineral Fiber Insulation, 1-inch thick.
 - b. Refrigerant Suction: Elastomeric cellular foam – twin-tube, 1-inch thick.
 - c. Refrigerant Hot Gas: Elastomeric cellular foam – twin-tube, 1-inch thick.

3. Other Systems:
 - a. Condensate Drains from Combustion Equipment: Not Required.

SCHEDULE OF MINIMUM PIPE INSULATION THICKNESS (IN INCHES)					
Fluid Design Operating Temp Range	Nominal Pipe or Tube Size, in.				
	<1	1 – <1-1/2	1-1/2 – <4	4 - <8	=>8
Heating Systems (Steam, Steam Condensate, Hot Water)					
>350	4.5	5.0	5.0	5.0	5.0
251 – 350	3.0	4.0	4.5	4.5	4.5
201 – 250	2.5	2.5	2.5	3.0	3.0
141 – 200	1.5	1.5	2.0	2.0	2.0
105 – 140	1.0	1.0	1.5	1.5	1.5
<105	0.5	0.5	1.0	1.0	1.0
Cooling Systems (Refrigerant)					
>60	0.5	0.5	0.5	0.5	1.0
40 – 60	0.5	0.5	1.0	1.0	1.0
<40	0.5	1.0	1.0	1.0	1.5

- B. Equipment:
 1. Hydronic System Equipment:
 - a. Material: Elastomeric Cellular Foam.
 - 1) Thickness: Per pipe insulation schedule. Select for rated temperature range with 2-inch equivalent pipe.
 - 2) Applicable Equipment:
 - a) Air Separators.
- C. Ductwork:
 1. Supply and Return Ducts:
 - a. Insulation:
 - 1) Material: Rigid (exposed, mech rooms) or flexible (concealed) glass fiber ductwork insulation.
 - 2) Thickness: Per Duct Insulation Schedule included in this Section.
 - 3) Vapor Retarder: Per Duct Insulation Schedule included in this Section.
 - 4) Weatherproof Barrier: Per Duct Insulation Schedule included in this Section.
 2. Transfer Air Duct:
 - a. Duct Liner Material: Elastomeric cellular foam or glass fiber internal duct liner.
 - b. Thickness: 1 inch thick.
 3. Exhaust and Relief Ducts:
 - a. Within 10 feet of Exterior Openings:
 - 1) Insulation Material: Flexible glass fiber ductwork insulation.
 - 2) Thickness: Per Duct Insulation Schedule included in this Section.
 - 3) Vapor Retarder: Required.
 - b. Exposed to Outdoor Air:
 - 1) Insulation Material: Rigid glass fiber ductwork insulation.
 - 2) Thickness: Per Duct Insulation Schedule included in this Section.
 - 3) Vapor Retarder: Required.
 - 4) Weatherproof Barrier: Required.

SCHEDULE OF MINIMUM PIPE INSULATION THICKNESS (IN INCHES)					
Fluid Design Operating Temp Range	Nominal Pipe or Tube Size, in.				
	<1	1 – <1-1/2	1-1/2 – <4	4 - <8	=>8
Heating Systems (Steam, Steam Condensate, Hot Water)					
>350	4.5	5.0	5.0	5.0	5.0
251 – 350	3.0	4.0	4.5	4.5	4.5
201 – 250	2.5	2.5	2.5	3.0	3.0
141 – 200	1.5	1.5	2.0	2.0	2.0
105 – 140	1.0	1.0	1.5	1.5	1.5
<105	0.5	0.5	1.0	1.0	1.0
Cooling Systems (Refrigerant)					
>60	0.5	0.5	0.5	0.5	1.0
40 – 60	0.5	0.5	1.0	1.0	1.0
<40	0.5	1.0	1.0	1.0	1.5

D. Equipment:

1. Hydronic System Equipment:

a. Material: Elastomeric Cellular Foam.

- 1) Thickness: Per pipe insulation schedule. Select for rated temperature range with 2-inch equivalent pipe.
- 2) Applicable Equipment:
 - a) Air Separators.

E. Ductwork:

1. Supply and Return Ducts:

a. Insulation:

- 1) Material: Rigid (exposed, mech rooms) or flexible (concealed) glass fiber ductwork insulation.
- 2) Thickness: Per Duct Insulation Schedule included in this Section.
- 3) Vapor Retarder: Per Duct Insulation Schedule included in this Section.
- 4) Weatherproof Barrier: Per Duct Insulation Schedule included in this Section.

2. Transfer Air Duct:

- a. Duct Liner Material: Elastomeric cellular foam or glass fiber internal duct liner.
- b. Thickness: 1 inch thick.

3. Exhaust and Relief Ducts:

a. Within 10 feet of Exterior Openings:

- 1) Insulation Material: Flexible glass fiber ductwork insulation.
- 2) Thickness: Per Duct Insulation Schedule included in this Section.
- 3) Vapor Retarder: Required.

b. Exposed to Outdoor Air:

- 1) Insulation Material: Rigid glass fiber ductwork insulation.
- 2) Thickness: Per Duct Insulation Schedule included in this Section.
- 3) Vapor Retarder: Required.
- 4) Weatherproof Barrier: Required.

c. Other Exhaust Duct Locations:

- 1) Insulation not required.

MINIMUM REQUIRED DUCT INSULATION			
Duct Location	Supply Duct	Return Duct	Exhaust Duct
Exterior	R-12.0, V, W	R-12.0, V, W	R-12.0, V, W
Attics	R-12.0, V	R-12.0, V	R-6.0, V
Duct to Space delta-T: >40 degrees F	R-5.0, V	-	R-5.0, V
Duct to Space delta-T: 15-40 degrees F	R-3.3, V	-	R-3.3, V

Duct to Space delta-T: <15 degrees F	-	-	-
Within Conditioned Spaces	NOTE 3	-	-
Notes:			
1: V indicated Vapor Retarder			
2: W indicates Weatherproof Barrier			
3: If supply air temperature rise is greater than 3 degrees F, duct insulation is required.			

END OF SECTION

SECTION 23 09 00 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temperature sensors.
 - 2. Occupancy sensor.
 - 3. Current sensors.
 - 4. Control air dampers.
 - 5. Control valves.
 - 6. Electric damper actuators.
 - 7. Transformers.
- B. Related Sections:
 - 1. Section 23 05 13 – Common Motor Requirements for HVAC Equipment: Product requirements for electric motors.
 - 2. Section 23 09 23 – Direct-digital Control System for HVAC: Product requirements for DDC control equipment.
 - 3. Section 23 09 93 – Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
 - 4. Section 23 21 16 – Hydronic Piping Specialties: Product requirements for thermometer sockets.
 - 5. Section 23 33 00 – Air Duct Accessories: Product requirements for duct mounted thermometers.
 - 6. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 – Laboratory Methods of Testing Louvers for Rating.
- B. American Society of Mechanical Engineers:
 - 1. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- C. ASTM International:
 - 1. ASTM B32 – Standard Specification for Solder Metal.
 - 2. ASTM B280 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
 - 3. ASTM D1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
- D. Federal Communications Commission:
 - 1. FCC Part 15.
- E. National Electrical Manufacturers Association:
 - 1. NEMA DC 3 – Residential Controls - Electrical Wall-Mounted Room Thermostats.
- F. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
- G. National Institute of Standards and Technology:
 - 1. NIST – Policy on Traceability.
- H. Underwriters Laboratory, Inc.:
 - 1. UL-873 – Temperature Reading and Indicating Equipment.
 - 2. UL 60730-1, 60730-2-9, Automated Electrical Controls.

1.3 SYSTEM DESCRIPTION

- A. The Temperature Controls Contractor (TCC) as a subcontractor to the Mechanical Contractor, is responsible for items in this Section.

1.4 SUBMITTALS

- A. 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.
- B. Product Data: Submit description and engineering data for each control system component. Include sizing as requested.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.
- B. Operation and Maintenance Data: Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Control Air Damper Performance: Test in accordance with AMCA 500.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept controls on site in original factory packaging. Inspect for damage.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 TEMPERATURE SENSORS

- A. Manufacturers:
 - 1. Automatic Components, Inc. (ACI).
 - 2. Veris Industries.
 - 3. MAMAC Systems, Inc.
- B. Electronic Room Temperature Sensor:
 - 1. Type: NEMA DC 3, 24 volts or 120 volts.
 - 2. Performance: Minimum accuracy of 0.36 degrees F, minimum stability of 0.23 degrees F.
 - 3. Service: cooling and heating.
 - 4. Covers: Locking with concealed setpoint.
 - 5. Features:
 - a. Temperature signal.
 - b. Temperature set point adjustment knob/wheel.
 - c. Occupancy override button.

- C. Room Temperature Sensor Accessories:
 - 1. Insulating Bases: For sensors located on exterior walls.
- D. Immersion Well Sensor:
 - 1. Stainless steel immersion well for fluid temperature sensors. Wells must be filled with heat transfer compound. Provide pipe fittings and adaptors as required to allow proper sensing of fluid temperature in main pipe..
 - 2. Length: As required for proper fluid sensing.
- E. Air-stream Sensor:
 - 1. Provide appropriate length probe sensor for duct size with NEMA type 1 enclosure. Averaging Sensor:
 - a. Provide a 24-foot averaging sensor with sensing elements every 3 feet minimum. Sensor must provide 75% coil area coverage; provide longer lengths as required.

2.2 OCCUPANCY SENSOR

- A. By Others. Refer to Section 26 27 26 – Wiring Devices.

2.3 CURRENT SENSORS

- A. Manufacturers:
 - 1. Automatic Components, Inc. (ACI).
 - 2. Veris Industries.
 - 3. MAMAC Systems, Inc.
 - 4. Hawkeye Energy Solutions.
- B. Analog current sensor shall be loop powered, fully isolated with a 4 to 20 ma or 2 to 10 volt DC output, sensor through-hole to accommodate up to #2/0 THHN insulated wire suitable for sensing up to 200 amperes, and provided with over-range protection. Sensor shall provide accuracy of plus or minus 0.5 percent of full scale, linearity and repeatability of plus or minus 0.1 percent of full scale, and response time of no less than 300 milliseconds to 99 percent of full scale.
- C. Current status switches:
- D. Provide an accurate current switch rated to sense the proper amperage of the load that is being monitored.

2.4 CONTROL AIR DAMPERS

- A. Refer to Section 23 33 00. Provided by Mechanical Contractor.

2.5 CONTROL VALVES - BALL

- A. Manufacturer:
 - 1. Belimo Aircontrols, Inc.
 - 2. Schneider Electric. Model: DuraDrive Series.
- B. All proportional controlled valves shall be controlled via 0-10VDC or 4-20ma signal. No floating valve control will be accepted.
- C. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system unless otherwise indicated. Provide valves with configurations and flow rates as indicated on drawings. Stem and ball shall be stainless steel. Close off pressure shall be 125 psi or greater per valve.
- D. Sizing: 3 psig maximum pressure drop at design flow rate.
- E. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
- F. Modulating proportional control, 0-10VDC or 4-20ma.

1. Applicable Equipment:
 - a. VAV terminal units.

2.6 ELECTRIC DAMPER ACTUATORS

- A. Manufacturers:
 1. Belimo Aircontrols, Inc.
 2. Schneider Electric. Model: DuraDrive Series.
 3. Siemens Industry, Inc.
- B. Operation: Two-position or reversing type proportional motor, as determined by location and application.
- C. Enclosure Rating: NEMA 250 Type 1 Enclosure.
- D. Mounting: Direct mount.
- E. Stroke: Maximum 150 seconds end to end full stroke, Maximum 20 seconds return to normal for spring return.
- F. Protection: Electronic stall protection.
- G. Control Input: 0-10 VDC or 0-20 mADC.
- H. Power: Nominal 24 or 120 volt AC.
- I. Torque: Size for minimum 150 percent of required duty.
- J. Duty cycle: rated for 65,000 cycles.
- K. Accessories:
 1. Cover mounted transformer.
 2. Auxiliary potentiometer.
 3. Damper linkage.
 4. Direct drive feedback potentiometer.
 5. Output position feedback.
 6. Field selectable rotational, spring return direction, field adjustable zero and span.
 7. End switch.

2.7 TRANSFORMERS

- A. Manufacturers:
 1. Square D (Schneider Electric).
 2. Veris Industries.
 3. MAMAC Systems, Inc.
 4. Honeywell International, Inc.
- B. Provide adequate low voltage transformer power to all DDC controllers. Transformers shall not be loaded greater than 75% of rated VA capacity.
- C. Transformer locations and equipment served by transformer must be noted and documented on drawings and final as-builts.
- D. Transformers shall be equipped with circuit protection for the low voltage circuit.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify building systems to be controlled are ready to operate.
- B. Verify that conditioned power supply is available to control units.

- C. Verify air handling units and ductwork have been accepted and air filters are in place before installing sensors in air streams.
- D. Verify location of thermostats and other exposed control sensors with Drawings before installation.

3.2 INSTALLATION

- A. Install equipment level and plumb.
- B. Install thermostats, humidistats, space temperature sensors, and other exposed control sensors after locations are coordinated with other Work.
- C. Install thermostats, humidistats, space temperature sensors, and other exposed control sensors 60 inches (or 48 inches above floor when required for ADA compliance). Align with light switches.
- D. Install freeze protection thermostats using flanges and element holders.
- E. Install carbon monoxide (CO) alarms in all new and existing rooms containing a fuel-burning appliance per 2020 Minnesota Mechanical and Fuel Gas Code. CO alarms shall be UL 2034 listed.
- F. Provide separable sockets for liquids and flanges for air bulb elements.
- G. Install thermostats as indicated on Drawings.
- H. Install guards on thermostats in public areas, entrances, gymnasiums, and as indicated on Drawings.
- I. Install control panels adjacent to associated equipment on vibration free walls or freestanding supports. Use one cabinet for each system. Install engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- J. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- K. Install conduit and electrical wiring in accordance with Section 26 05 03.
- L. Control wiring shall be installed in EMT conduit in inaccessible locations such as walls and floors and where exposed on walls.
- M. Install labels and nameplates to identify control components. Refer to Section 23 05 53. Label as indicated on Drawings and coordinate all labels with the Mechanical Contractor, Plumbing Contractor, and Electrical Contractor.

3.3 FIELD QUALITY CONTROL

- A. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.4 DEMONSTRATION AND TRAINING

- A. Demonstrate complete operation of systems, including Sequence of Operation prior to Date of Substantial Completion.
- B. Demonstrate complete and operating system to Owner. Refer to Section 23 09 93.

END OF SECTION

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SECTION 23 09 23 – DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes control equipment and software.
- B. Related Sections:
 - 1. Section 23 09 00 - Instrumentation and Control for HVAC: Control system components.
 - 2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.

1.2 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 135 – BACnet: A Data Communication Protocol for Building Automation and Control Networks.

1.3 SYSTEM DESCRIPTION

- A. The Temperature Controls Contractor (TCC), as a subcontractor to the Mechanical Contractor, is responsible for items in this Section.
- B. Building Management System (BMS): Distributed process control system consisting of centralized server, central TCP/IP communications, and remote control systems to control and monitor the following building systems:
 - 1. Heating, ventilating, and air conditioning systems.
 - 2. Energy management and monitoring.
 - 3. Power and electric management.
- C. Central Control System: Configure central processing units, mass memory units, data terminal units, and related software to perform the following functions:
 - 1. Provide automatic control of building systems.
 - 2. Develop, store, access, and update building management database.
 - 3. Provide operator interface with system.
 - 4. Provide secured, web based interface for access via the intranet and internet.
 - 5. Display and record system operation.
- D. Central Communication System: Configure central communication units, data communication network, and related software to control input and output between central control system and remote control systems.
- E. Remote Control System: Configure remote control units, input sensing devices, and output control elements to perform the following functions:
 - 1. Process variable sensing, signal transmitting, and signal conversion for each input point.
 - 2. Signal conversion, transmitting, and operation of control drive or other element for each output point.
 - 3. Receive remote control programs and system data from central communication system.
 - 4. Manual entry of remote control programs.
 - 5. Storage of data and remote control programs.
 - 1) Execute remote control program commands.
 - 2) Transmit local status data to central communication system.
 - 3) Execute commands received from central communication system.
- F. Every point on the system shall have the ability to be trend logged.
- G. Every Damper, Valve, and Variable Frequency Drive (VFD) shall have a separate output point, controllable individually from the BAS.

- H. The BMS shall control the direct-digital controls system for HVAC. The BAS shall also integrate with the fire alarm system to monitor smoke management functions, such as smoke damper position. The BMS shall be controlled through a single graphical, web-based operator interface that allows for instant access to any sub-system through a standard browser. Systems requiring two or more different PC workstations are not acceptable.
- I. The BMS workstation and HVAC controllers shall be designed to provide PC-based programming and microcomputer controllers of modular design providing distributed processing capability. Contractor must provide manufacturer's Protocol Implementation Conformance Statement (PICS) for workstation software and every controller model that are installed.
- J. Automatic temperature controls field monitoring and control system using field programmable microprocessor based controllers. System shall be capable of communicating with other building systems installed with ASHRAE 135 compatible devices.
- K. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- L. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- M. Provide graphics package and new PC Workstation that includes display of all essential points. Graphics are to be designed and modified to Owners preference. Owner shall determine final acceptance of complete graphic package.
- N. Provide new and modify existing controls for air handling units, variable air volume terminals, reheat coils, pumps, and exhaust fans when directly connected to control units.
- O. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.
- P. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.
- Q. All core components (database, programming files, graphics, software, licenses, and software/hardware tools) necessary to make programming adjustments at all levels shall be included. The Owner and Architect/Engineer shall be able to review and modify every aspect of the system without exception. Any piece of controls equipment (i.e. sensors, controllers, workstation, software, license, or software/hardware tool, etc.) found not to be provided shall be the responsibility of the Temperature Control Contractor to provide at there expense. The Architect/Engineer shall determine if the contractor has not provided all necessary components.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide system which can be fully accessible via the internet. The Owner will provide for one connection to its own LAN per building and will assign a static IP address for the automation system. Under no circumstances shall the facility's LAN be utilized for communication among system controllers. The owner shall provide fiber network space for multiple building connections and communication back to the central server.
- B. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
 - 1. Graphic display. A graphic with 25 dynamic points shall display with current data with 5 sec.
 - 2. Graphic Refresh. A graphic with 25 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 10 sec.

3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 5sec.
4. Object Command. Devices shall react to command of a binary object within 5 sec. Devices shall begin reacting to command of an analog object within 5 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Execution times shall be consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Execution times shall be consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the networks shall receive alarms with 20 sec of other workstations.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy
10. Control Stability and Accuracy. Control loops shall maintain measured variable at plus or minus 5 percent of set point. Control loop stability shall be achieved 15 minutes or less after startup to avoid energy waste, excessive noise, equipment damage, or comfort issues.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate the following:
 1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
 2. Connected data points, including connected control unit and input device.
 3. System graphics showing monitored systems, data (connected and calculated) point addresses, and operator notations.
 4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
 5. Description and sequence of operation for operating, user, and application software.
 6. Coordinate submittals with information requested in Section 23 09 93.
- B. Provide a detailed Valve Schedule for all control valves including: Zone/equipment served, Tag ID, fluid type, valve part #, actuator part#, voltage, spring range, torque, valve type, valve size, pipe size, valve action, connection type, GPM, CV, pressure drop, close off PSI.
- C. Provide a detailed Variable Frequency Drive schedule.
- D. Front-End Graphical User Interface Submittal.
 1. Provide a hard copy color graphic for each primary device (air handling unit, heating plant, cooling plant, energy data, etc.).
 2. Provide floorplan overview graphics layout and proposed building subdivisions; indicate equipment and status locations being displayed.
 3. Provide a typical graphic for each air handling unit zone summary page.
 4. Provide a typical graphic for each terminal device.
 5. Provide graphics that show all hyperlinks to other pages identified.
 6. Submit within 60 days of the award of the general contract.
 7. Provide samples of energy monitoring spreadsheets to be used.
- E. Programming Submittal
 1. Indicate system graphics of monitored systems, data (collected and calculated), point addresses, and operator notations.
 2. Provide control program logic diagrams for all major systems.
 3. Include programmer comments and notation.
 4. The completed submittal must be submitted within 45 days after final engineer approval of the other controls submittals.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
 - 2. Submit data specified in "Submittals" in final "Record Documents" form.
- B. Operation and Maintenance Data:
 - 1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
 - 2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- C. Operation Verification Report:
 - 1. Submit report indicating results from operational testing showing that all control sequences are functioning properly.

1.7 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect electronic components from construction operations, dust, and adverse environmental conditions.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 COORDINATION

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Temperature Control Contractor (TCC) is required to coordinate with HVAC, Plumbing, and Electrical contractors and equipment suppliers so that all equipment supplied controls can be integrated into the Building Automation System. TCC is to coordinate with HVAC, Plumbing, and Electrical contractors and equipment suppliers for all field mounted controls components. TCC will be required to install these components or coordinate with HVAC, Plumbing, and Electrical contractors for these installations. TCC will be responsible for all rough-ins to support any and all control components that are not shown on the electrical plans.
- C. TCC shall provide and install conditioned electrical circuits for control units and operator workstation. TCC shall hire a licensed electrician as needed to provide and install all power circuits required for DDC hardware.
- D. TCC shall coordinate all dampers and valve locations with HVAC and Plumbing contractors.
- E. Provide documentation of successful point-to-point verification and sequence of operation verification. This shall be provided to the mechanical engineer, Testing & Balancing (TAB) Contractor, and the owners Commissioning agent. This shall be the point at which the TAB contractors work may commence.

- F. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows:
 - 1. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation regardless of where within the contract documents those products are described.
 - 2. TCC shall coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
 - 3. TCC shall be responsible for the integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.
- G. Test and Balance:
 - 1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
 - 2. Train Test and Balance Contractor to use control system interface tools.
 - 3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
 - 4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.
- H. TCC shall coordinate all installation work with other trades to prevent space interference with other systems and materials. If installation without coordination causes interference with work of other trades, TCC shall correct conditions without extra charge.
- I. Contractor shall arrange for work inspection by local or state Authorities Having Jurisdiction.

1.12 WARRANTY

- A. Furnish five year manufacturer warranty for all furnished components and two year complete labor for all installed components

PART 2 PRODUCTS

2.1 SAFETY CONTROLS FOR ALL UNITS

- A. Coordinate factory installed smoke detectors in packaged equipment with the equipment manufacturer.
- B. Close outside air dampers and exhaust air dampers when unit fan is not in operation. Unless otherwise noted.
- C. Interlock smoke detectors to air handlers for shutdown as specified in Section 23 09 93 – Sequence of Operations for Direct Digital Control.
- D. Provide sensor on discharge of heating coil to de-energize unit fan when temperature falls below 32 degrees F and close outside air dampers. If a freeze stat is utilized, Temperature control contractor shall provide a control strategy to minimize nuisance trips.

2.2 DIRECT DIGITAL CONTROLS

- A. Manufacturers:
 - 1. Schneider Electric by UHL (existing TCC for the building).
 - 2. Substitutions: Not Permitted.

2.3 SOFTWARE

- A. Central Processing Unit Operating System: Memory-resident, real-time, multi-user, multi-tasking operating system to support ten simultaneous real-time processes and two batch processes.
- B. Furnish the following operating system utilities:
 - 1. File create, copy, rename, move, delete

2. Furnish high-level programming language compiler, with subroutines and remote control unit program instruction set to perform specified sequence of operation.
- C. Operator Interface Software:
 1. Use English language displays, commands, and responses.
- D. Remote Control Software: Furnish the following functions:
 1. Update input and output values at intervals of one second.
 2. Input and output conversion, scaling, offset, and nonlinear input correction.
 3. Error checking of input.

2.4 SYSTEM TOOLS

- A. Provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone softer programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.
 1. Automatic System Database Configuration: Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
 2. Controller Memory Download: Operators shall be able to download memory from the system database to each controller.
 3. System Configuration: Operators shall be able to configure the system.
 4. Online Help: Context-sensitive online help for each tool shall assist operators in operating and editing the system.
 5. Security: System shall require a user name and password to view, edit, add, or delete data.
 - a. Operator Access: Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.
 - b. Automatic Log Out: Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic lock out delay.
 - c. Encrypted Security Data: Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
 6. Alarm Processing: System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.
 7. System Diagnostics: System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
 8. Alarm Messages: Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
 9. Alarm Reactions: Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send email, send page, and audibly annunciate.
 10. Alarm Maintenance: Operators shall be able to view system alarms and changes of state chronologically, to acknowledge an delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
 11. Object and Property Status and Control: Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

12. Trend Configuration: Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Section 25 00 11 – Sequence of Operations for Direct Digital Controls. Trends shall be BACnet trend objects.

2.5 CONTROL UNITS

- A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.
- B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.
- C. Control Units Functions:
 1. Monitor or control each input/output point.
 2. Completely independent with hardware clock/calendar and software to maintain control independently.
 3. Acquire, process, and transfer information to operator station or other control units on network.
 4. Accept, process, and execute commands from other control unit's or devices or operator stations.
 5. Access both data base and control functions simultaneously.
 6. Record, evaluate, and report changes of state or value occurring among associated points. Continue to perform associated control functions regardless of status of network.
 7. Perform in stand-alone mode:
 - a. Start/stop.
 - b. Duty cycling.
 - c. Automatic Temperature Control.
 - d. Demand control via a sliding window, predictive algorithm.
 - e. Event initiated control.
 - f. Calculated point.
 - g. Scanning and alarm processing.
 - h. Full direct digital control.
 - i. Trend logging.
 - j. Global communications.
 - k. Maintenance scheduling.
- D. Global Communications:
 1. Broadcast point data onto network, making information available to other system controls units.
 2. Transmit input/output points onto network for use by other control units and use data from other control units.
- E. Input/output Capability:
 1. Discrete/digital input (contact status).
 2. Discrete/digital output.
 3. Analog input.
 4. Analog output.
 5. Pulse input (5 pulses/second).
 6. Pulse output (0-655 seconds in duration with 0.01-second resolution).
- F. Provide a minimum of 10% spare point capacity for each point type: AO, DO, UI.
- G. Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs. Furnish control units with percent spare capacity.
- H. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

- I. Upload/Download Capability: Download from or upload to operator station.
- J. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
 - 1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from workstation.
 - 2. Control output points but change only database state or value; leave external field hardware unchanged.
 - 3. Enable control-actions on output points but change only data base state or value.
- K. Local display and adjustment panel: [Portable] [or] [Integral to] control-unit containing digital display, and numerical keyboard. Display and adjust:
 - 1. Input/output point information and status.
 - 2. Controller set points.
 - 3. Controller tuning constants.
 - 4. Program execution times.
 - 5. High and low limit values.
 - 6. Limit differential.
 - 7. Set/display date and time.
 - 8. Control outputs connected to the network.
 - 9. Automatic control outputs.
 - 10. Perform control unit diagnostic testing.
- L. Points in "Test" mode.

2.6 GRAPHICAL USER INTERFACE

- A. The control system graphics shall consist of a series of graphic displays which are interlinked for the purposes of navigation and reporting.
- B. Graphics shall be navigable by use of the building floorplan overviews. Every system servicing an area shall be accessible graphically. All HVAC equipment locations and current status shall be positioned on graphics in the actual locations of the equipment.
- C. Indicate zone layout by color shading floorplan overviews.
- D. Provide individual links to trend logs/graphs directly from the point location on the graphic.
- E. Provide a link to the as-built drawings and O&M manuals directly from the graphics.
- F. Provide a link to the as-built sequence of operations directly from the graphics.
- G. All set points shall be located next to the process variable being controlled.
- H. All equipment graphics shall be customized to display actual unit configuration; control devices and data shall be displayed in actual locations relative to the piece of equipment displayed on the graphics.
- I. All adjustable set points shall have a clickable or graphical slider to adjust the value.
- J. Every graphical point displayed shall have a timed override feature. All overrides shall be password protected.
- K. All set point resets (discharge air reset, etc.) shall have a link to the reset adjustments; and indicate the values used to determine the reset.
- L. The graphic user interface shall be made available via the internet in the same form, appearance and functionality with which it can be accessed from the operator workstation. All set points, schedules, trending, alarms and graphic screens shall be made accessible through this interface.
- M. A security firewall shall be provided to password protect access to the control system via the operator workstation, mobile workstation and all access via the internet.

- N. Provide a separate zone summary for each Air Handler indicating the following as applies:
 - 1. Space temp
 - 2. Space set point
 - 3. Supply temp
 - 4. Heating valve/stage
 - 5. CFM
 - 6. CFM set point
 - 7. Damper position
 - 8. Link to equipment details
- O. Graphics shall display all equipment modes, for example, "economizer mode".
- P. Whenever an alarm is generated within the system, the graphic system shall show the alarm on the main system page as well as the page associated with the alarmed equipment.
- Q. Provide floorplan overview graphics for all areas indicating zone temperatures. Provide red blinking text for zone temperatures that are 5 degrees F above set point; and blue blinking text for zone temperatures that are 5 degrees F below set point.
- R. Each graphic shall be updated every 15 seconds or less.
- S. Animated graphics for motor driven equipment shall show rotation when the unit is active and shall be motionless when the equipment is off.
- T. Animated graphics for dampers and valves shall show relative positions of dampers graphically and percent open text display. 0% shall represent no flow, damper closed, no speed etc. 100% shall represent full flow, damper open, full speed etc.
- U. Graphics shall indicate when multiple actuators are controlled from a common signal.
- V. Update final graphics with owner requested revisions including room names, numbers, and equipment identifications.
- W. All graphics are subject to final approval by Owner and Engineer.
- X. Graphic editing tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files.
- Y. Graphics library of standard HVAC equipment graphics shall include all HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, unit ventilators, etc. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file shall be compatible with graphics generation tools.

2.7 TRENDING

- A. Each control unit will store samples of control unit's data points. Upload to server/storage location shall occur when controller memory reaches 80% full.
- B. Update file continuously at discretely assignable intervals.
- C. Automatically initiate upload request and then store data on hard disk. All trend data collected shall be permanently stored and backed up via central server that includes backup measures.
- D. Archive data shall be accessible for trending to compare year to year data.
- E. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
- F. Coordinate sampling with on/off state of specified point.

- G. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs. data.
- H. Sample up to 30 points, real or computed, with each point capable of collecting 60 samples at intervals specified in minutes, hours, days, or month.
- I. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique color, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.
- J. Trending shall be implemented in a manner that does not affect system performance, communication, graphical update times, etc.
- K. Coordinate the recording interval and storage duration with the Owner and engineer before Substantial Completion.

2.8 ALARMS

- A. Each control unit will store samples of control unit's data points. Upload to server/storage location shall occur when controller memory reaches 80% full.
- B. All process variables and inputs shall alarm when the value is out of operating range, indicating a failed sensor.
- C. Coordinate all alarm delays with Owner/Engineer to provide accurate and reliable alarming.
- D. All alarms shall trigger an audible alarm sound on the operator workstation when the alarm is active.
- E. Allow definition of minimum of 20 messages, each having minimum length of 60 characters for each individual message.
- F. All alarms shall have an acknowledgement required feature.
- G. Assign alarm messages to system messages including point's alarm condition, points off-normal condition.
- H. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.
- I. System shall be capable of grouping alarms into different categories and each category shall be assignable to a phone number or email address.
- J. System shall be configured and installed to call phone numbers and to sent emails and text messages when an alarm is activated.

2.9 TIME SCHEDULES

- A. All time schedules shall have an optimization feature. The maximum start or stop optimization shall be 2 hours. Optimization shall take into consideration longer time in the schedule has been off for longer than 36 hours. Optimized start shall bring all space set points within 1 deg F of set point prior to normal schedule start.
- B. Provide graphics based scheduling control of all systems specified in the control sequences as being controlled via a schedule.
- C. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.
- D. Provide program times for each day of week, per point, with one-minute resolution.
- E. Provide for holidays, minimum of 5 consecutive holidays.
- F. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

- G. Coordinate initial schedule parameters with Owner prior to Substantial Completion.
- H. Interlocking: Permit events to occur, based on changing condition of one or more associated master points.

2.10 REPORTS AND LOGS

- A. Operator shall be able to select, to modify, to create, and to print reports and logs. Report data shall be stored and used in a format accessible by standard spreadsheet and word processing programs.
- B. Standard Reports. Furnish the following standard system reports:
 - 1. Objects, System objects and current values filtered by object type, by status (in alarm, locked, normal) by equipment, by geographic location or by combination of filter criteria.
 - 2. Alarm Summary. Current alarms and closed alarms. System shall permanently retain closed alarms.
 - 3. Logs. System shall log the following to a database or text file and shall permanently retain data.
 - a. Alarm History
 - b. Trend Data. Operator shall be able to select trends to be logged.
 - c. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

2.11 LOCAL AREA NETWORKS (LAN):

- A. Coordinate with Owner on single point network jack location. All network wiring within the building is the responsibility of the TCC.
- B. Furnish communication between control units over local area network (LAN).
- C. LAN Capacity: Not less than 32 stations or nodes.
- D. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
- E. LAN Data Speed: Minimum 19.2 Kb.
- F. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
- G. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.
- H. Network Support: Time for global point to be received by any station, less than 3 seconds. Furnish automatic reconfiguration when station is added or lost. In event transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.12 PROGRAMMING APPLICATION FEATURES

- A. Alarm Messages:
 - 1. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, and hardware elements advisories.
 - 2. Output assigned alarm with "message requiring acknowledgment".
 - 3. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditioned power supply is available to control units and to operator workstation.
- B. Verify field end devices and wiring is installed prior to installation proceeding.

3.2 INSTALLATION

- A. Install in accordance with ASHRAE 135.
- B. Perform all setup and installation procedures necessary to provide a complete and operating workstation and portable operator's terminal. Coordinate with Owner's IT manager as necessary for network connections, etc.
- C. Install in accordance with all manufacturer's recommendations for equipment provided under this Contract.
- D. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- E. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.
- F. Install conduit and electrical wiring in accordance with Section 26 05 03.
- G. Install electrical material and installation in accordance with appropriate requirements of Division 26.
- H. Install sensors according to manufacturer's recommendations.
- I. Install outdoor air temperature sensors on north wall at designated location with sun shield.
- J. Mount sensors rigidly and adequately for operating environment.
- K. Install room temperature sensors on concealed junction boxes properly supported by wall framing.
- L. Smoke detectors, freezestats and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Auto reset on all switches shall be in a visible, easily accessible location. Provide isolated contacts that allow DDC software to monitor safety switch.
- M. Seal wall penetrations to prevent sensor readings from being affected by air transmitted from other areas.
- N. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.
- O. Install mixing plenum low limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m² (1 ft²) of coil area.
- P. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
- Q. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.
- R. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.

3.3 ADJUSTING & CHECKOUT

- A. Adjust all set points, alarm points, and display configurations so the BAS performs as specified and as required by the test and balance contractor.
- B. Test each sequence of BAS by simulation of normal, off normal, and alarm conditions.
- C. TCC shall provide a documented checkout procedure when installation is complete. Check out shall consist of at least two field technicians verifying functional operation of all control devices.
- D. When this verification process is complete, the TCC shall submit a Control Readiness Letter. See sample at the end of this section.

- E. Where this contract requires commissioning, this contractor shall participate as the BAS integrator as defined in other specification sections. In any case, this contractor shall cooperate fully to provide verification to the commissioning authority or the engineer that the system is in conformance with the design intent as expressed in the contract.
- F. Enter BAS database and furnish backup copy on CD. During the maintenance service period, provide updated copies of the CD as changes are made to the system.
- G. Adjust alarm points to eliminate any nuisance alarms.

END OF SECTION

CONTROLS READINESS LETTER

I hereby certify the following have been completed:

- A. ALL HVAC EQUIPMENT AND RELATED CONTROLS HAVE BEEN VERIFIED AS INSTALLED AND/OR CONNECTED.
- B. All DDC components are labeled and have the covers installed.
- C. All standalone and computer based equipment and related controls have been tested for connection and operation.
- D. All DDC control software is INSTALLED, PROGRAMMED and TESTED for proper control sequence operation.
- E. All DDC front end computer graphics are PROGRAMMED, TESTED, and in automatic ('hands-off') operation.
- F. All equipment intended for time schedule based or interlocked operation is programmed to run accordingly and has been verified. Specifically, all equipment is in automatic operation, no manual control is acceptable.
- G. Required DDC system access (password, rights, etc.) is available on site through the building engineer or turned over system documentation.
- H. All DDC controlled equipment is configured for proper display and testability.
- I. All operating functions are easily operator overridable to facilitate testability including but not limited to set points, sensors, and actuators.
- J. All control sequences have their related set point, sensor, and resultant action on the screen and in a useful proximity to each other.
- K. All alarm limits, if used, are programmed to appropriate values for normal use and minimize false alarms.
- L. Motor status points are be configured and set to indicate actual belt/coupler break conditions.
- M. If text and graphic formats are available on the BAS computer front end both operator display options are equally complete and matched for displaying the above items.

Exceptions to the above readiness for commissioning/punchlist are listed and described below.

Signature affirms that the above items are, to the best of my knowledge, true and ready to be verified by the engineer or commissioning agent. I hereby agree to pay all additional costs accumulated by the engineer/owner during the commissioning/punchlist process due to incomplete work as described above.

Project

Manager:

Project:

Controls

Technician:

Phone

Number:

SECTION 23 09 93 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sequence of operation for:
 - 1. General:
 - a. Zone Sensors
 - b. Building Sensors
 - 2. Terminal Air Systems:
 - a. Air Terminal Units – Single-Duct VAV Boxes with HW Reheat
 - b. Exhaust Fans
- B. Related Sections:
 - 1. Section 23 09 00 - Instrumentation and Control for HVAC: For equipment, devices, and system components to implement sequences of operation.
 - 2. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SYSTEM DESCRIPTION

- A. The Temperature Controls Contractor (TCC), as a subcontractor to the Mechanical Contractor, is responsible for items in this Section.

1.3 DEFINITIONS

- A. AI – Analog Input.
- B. AO – Analog Output.
- C. BAS – Building Automation and Control System.
- D. BI – Binary (Digital) Input.
- E. BO – Binary (Digital) Output.
- F. CCV – Cooling Coil Valve.
- G. DAT – Discharge Air Temperature
- H. EA – Exhaust Air
- I. EAT – Entering Air Temperature
- J. EWT - Entering Water Temperature
- K. GUI – Graphical User Interface.
- L. HCV – Heating Coil Valve.
- M. LAT – Leaving Air Temperature
- N. LWT – Leaving Water Temperature
- O. OA – Outdoor Air
- P. OAF – Outdoor Air Flow
- Q. OAT – Outdoor Air Temperature
- R. BMS – Proprietary Boiler Management System.
- S. PI Loop – Proportional-Integral Loop

- T. PID Loop - Proportional-Integral-Derivative Loop
- U. RA – Return Air
- V. SWT – Supply Water Temperature
- W. ZAT – Zone Air Temperature

1.4 SUBMITTALS

- A. 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 23 09 00 and Section 23 09 23 .

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and setpoint of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. ALARMS, SETPOINTS, AND TIMERS

- 1. All Setpoints, Timers and Alarms listed in this Section shall be adjustable by Owner.
- 2. All Nuisance Alarms shall be corrected prior to Project Closeout.

B. TEMPERATURE AND HUMIDITY

1. ZONE SENSORS:

a. ALARM SCHEDULE:

- 1) All Zone Sensors shall have alarms. The zone temperature alarm setpoints shall be dynamically based upon the mode of operation. The BAS shall generate an alarm when:
 - 2) The zone temperature is 2 degrees F below the occupied and unoccupied zone heating setpoint after a 5-minute delay.
 - 3) The zone temperature is 2 degrees F above the occupied and unoccupied zone cooling setpoint after a 5-minute delay.

b. INPUTS:

- 1) Zone Air Temperature

3.2 TERMINAL AIR SYSTEMS

A. AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH HW REHEAT

1. GENERAL:

- a. OCCUPANCY SENSORS: For large spaces, provide enough occupancy sensors for adequate coverage. Coordinate with Electrical.
- b. Modify existing air terminal units as needed to maintain operation with existing air handling systems and associated zone temperature sensors. Note some of the temperature sensors are relocated, others to remain-in-place. Field verify with new plans.

2. TIME SCHEDULE:

- a. Each VAV box shall utilize the Time Schedule of its associated AHU.

3. OPERATING MODES:

- a. OCCUPIED MODE:
 - 1) OCCUPIED MODE shall be ENABLED when ALL of the following become TRUE
 - a) Associated AHU Time Schedule is ON or OFF.
 - b) Zone Occupancy Sensor signals OCCUPIED for time exceeding ACTIVE Timer.
 - 2) OCCUPIED MODE shall override STANDBY MODE.
 - 3) OCCUPIED MODE Timers:
 - a) ACTIVE Timer: 2 minutes (adjustable).
 - b) INACTIVE Timer: 15 minutes (adjustable).
 - c) Timer controlled by DDC Controller, not Occupancy Sensor Settings.
 - b. STANDBY MODE:
 - 1) STANDBY MODE shall be ENABLED when ALL of the following become TRUE
 - a) Associated AHU Time Schedule is ON.
 - b) Zone Occupancy Sensor signals UNOCCUPIED for time exceeding INACTIVE Timer.
 - c. UNOCCUPIED MODE:
 - 1) UNOCCUPIED MODE shall be ENABLED when ALL of the following become TRUE
 - a) Associated AHU Time Schedule is OFF.
 - b) Zone Occupancy Sensor signals UNOCCUPIED for time exceeding INACTIVE Timer.
- 4. ZONE TEMPERATURE CONTROL:**
- a. The VAV box shall maintain Zone Air Temperature (ZAT) Heating and Cooling Setpoints by the following means:
 - 1) ZAT is above Cooling Setpoint:
 - a) STAGE 1: Modulate VAV damper OPEN to MAXIMUM COOLING position.
 - 2) ZAT is below Heating Setpoint:
 - a) STAGE 1: Modulate HCV for Finned-Tube Radiation (if present) OPEN.
 - b) STAGE 2: Modulate HCV for VAV Reheat Coil OPEN.
 - c) STAGE 3: Modulate VAV damper OPEN to MAXIMUM HEATING position.
 - 3) ZAT is between Cooling Setpoint and Heating Setpoint:
 - a) VAV damper is at MINIMUM position.
 - b) HCV for VAV Reheat Coil is CLOSED.
 - c) HCV for Finned-Tube Radiation (if present) is CLOSED.
 - b. ZAT SETPOINTS:
 - 1) COOLING:
 - a) OCCUPIED: 76 degrees F (adjustable).
 - b) STANDBY: 78 degrees F (adjustable).
 - c) UNOCCUPIED: 86 degrees F (adjustable).
 - 2) HEATING:
 - a) OCCUPIED: 68 degrees F (adjustable).
 - b) STANDBY: 67 degrees F (adjustable).
 - c) UNOCCUPIED: 60 degrees F (adjustable).
 - 3) HYSTERESIS:
 - a) OCCUPIED: 2 degrees F (adjustable).
 - b) STANDBY: 2 degrees F (adjustable).
 - c) UNOCCUPIED: 10 degrees F (adjustable).
 - c. DAMPER POSITION SETPOINTS:
 - 1) MAXIMUM COOLING:
 - a) OCCUPIED: Refer to Drawing Schedules.
 - b) STANDBY: OCCUPIED MAXIMUM COOLING value (adjustable).
 - c) UNOCCUPIED: OCCUPIED MAXIMUM COOLING value (adjustable).
 - 2) MAXIMUM HEATING:
 - a) OCCUPIED: Refer to Drawing Schedules.
 - b) STANDBY: OCCUPIED MINIMUM value (adjustable).

- c) UNOCCUPIED: OCCUPIED MINIMUM value (adjustable).
- 3) MINIMUM:
 - a) OCCUPIED: Refer to Drawing Schedules.
 - (1) Note that this value shall not be less than the code minimum ventilation airflow requirement.
 - b) STANDBY: Fully CLOSED (adjustable).
 - c) UNOCCUPIED: Fully CLOSED.

5. ZONE REQUESTS:

- a. AHU REQUESTS:
 - 1) REQUESTS FOR DAT RESET:
 - a) Zone Cooling Request:
 - (1) Request Activated: VAV Damper Position opens above 95 percent OPEN.
 - (2) Request Deactivated: VAV Damper Position closes below 85 percent OPEN.
 - (3) Zone Disable: Provide a binary data enable point for each VAV Damper to ENABLE/DISABLE Cooling Requests.
 - (a) Eliminate Nuisance Alarms when Damper is DISABLED.
 - b) Zone Heating Request:
 - (1) Request Activated: VAV Reheat Coil Control Valve (RCCV) opens above 10 percent OPEN.
 - (2) Request Deactivated: VAV RCCV is fully CLOSED.
 - (3) Zone Disable: Provide a binary data enable point for each VAV RCCV to ENABLE/DISABLE Heating Requests.
 - (a) Eliminate Nuisance Alarms when Damper is DISABLED.
 - 2) REQUESTS FOR SUPPLY FAN CYCLING:
 - a) Unoccupied Zone Cooling Request:
 - (1) Request Activated: VAV Damper Position opens above 95 percent OPEN.
 - (2) Request Deactivated: VAV Damper Position closes below 85 percent OPEN.
 - (3) Zone Disable: Provide a binary data enable point for each VAV Damper to ENABLE/DISABLE Cooling Requests.
 - (a) Eliminate Nuisance Alarms when Damper is DISABLED.
 - b) Unoccupied Zone Heating Request:
 - (1) Request Activated: VAV Reheat Coil Control Valve (RCCV) opens above 10 percent OPEN.
 - (2) Request Deactivated: VAV RCCV is fully CLOSED.
 - (3) Zone Disable: Provide a binary data enable point for each VAV RCCV to ENABLE/DISABLE Heating Requests.
 - (a) Eliminate Nuisance Alarms when Damper is DISABLED.
 - 3) REQUESTS FOR SUPPLY FAN SPEED RESET:
 - a) Zone Pressure Request:
 - (1) Request Activated: VAV damper opens above 95 percent OPEN.
 - (2) Request Deactivated: VAV damper closes below 80 percent OPEN.
 - (3) Zone Disable: Provide a binary data enable point for each VAV Damper to enable/disable Pressure Requests.
 - (a) Eliminate Nuisance Alarms when Damper is DISABLED.
 - b) Valve Disable: NOT USED.
- b. HOT WATER LOOP REQUESTS:
 - 1) Control Valve Pressure Request:
 - a) Request Initiated: Control Valve opens above 90 percent OPEN.
 - b) Request Terminated: Control Valve closes below 80 percent OPEN.
 - c) Valve Disable: Provide a binary data enable point for each Valve to enable/disable the Control Valve in the algorithm.

(1) Eliminate Nuisance Alarms when Valve is DISABLED.

6. ALARM SCHEDULE:

- a. NUISANCE ALARMS: Time Delays and Setpoints shall be adjusted to eliminate Nuisance Alarms.
- b. ZONE AIR TEMPERATURE SENSOR:
 - 1) HIGH TEMPERATURE ALARM: Temperature above 100 degrees F (adjustable).
 - 2) LOW TEMPERATURE ALARM: Temperature below 50 degrees F (adjustable).
- c. OCCUPANCY SENSOR:
 - 1) SENSOR FEEDBACK ALARM: Zone UNOCCUPIED for 30 days (adjustable).
 - 2) SENSOR FEEDBACK ALARM: Zone OCCUPIED for 24 hours (adjustable).
- d. CONTROL VALVES:
 - 1) HEATING VALVE FEEDBACK ALARM: Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.
 - 2) HEATING VALVE FEEDBACK ALARM (FTR): Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.
- e. DAMPERS:
 - 1) VAV DAMPER FEEDBACK ALARM: Damper Commanded to Position, Damper Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

7. INPUT/OUTPUT SCHEDULE

- a. INPUTS
 - 1) Operating Mode (Occupied, Standby, Unoccupied)
 - 2) Zone Requests:
 - a) AHU DAT Zone Cool Request
 - b) AHU DAT Zone Heat Request
 - c) AHU Fan Unoccupied Cool Request
 - d) AHU Fan Unoccupied Heat Request
 - e) AHU Fan Zone Pressure Request.
 - f) HW Loop CV Pressure Request
 - 3) Zone Air Temperature
 - 4) Occupancy Sensor (multiple, if applicable).
 - 5) Reheat Coil Discharge Air Temperature
 - 6) Supply Airflow CFM
- b. OUTPUTS
 - 1) Heating Control Valve
 - 2) Heating Control Valve (FTR)
 - 3) Air Damper

B. EXHAUST FANS

1. TIME SCHEDULE:

- a. Each Exhaust Fan shall utilize the Time Schedule of the associated AHU serving that area.

2. TOILET EXHAUST FANS:

- a. EXHAUST FANS ON:
 - 1) Fans shall only run when the following are ALL TRUE:
 - a) Associated AHU Time Schedule is ON.
 - b) Motorized damper has proven OPEN.
 - c) Local switch/es are in ON position.
- b. EXHAUST FAN OFF:
 - 1) Fans shall NOT run when ANY of the follower are TRUE:
 - a) Associated AHU Time Schedule is OFF.
 - b) Motorized damper has not proven OPEN.
 - c) Local switch/es are in OFF position.

3. FAN STATUS:

- a. Monitor the status of Exhaust Fans.

4. INPUT/OUTPUT SCHEDULE

- a. INPUTS
 - 1) Fan Command
- b. OUTPUTS
 - 1) Fan Status
 - 2) Occupancy/Vacancy Sensor Status (as applicable)
- c. ALARMS
 - 1) Fan Commanded ON, Fan Status OFF
 - 2) Fan Commanded OFF, Fan Status ON

END OF SECTION

SECTION 23 21 13 – HYDRONIC PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Heating water piping, above ground.
 - 2. Chilled water piping, above ground.
 - 3. Equipment drains and over flows.
 - 4. Unions and flanges.
 - 5. Pipe hangers and supports.
 - 6. Valves.
- B. Related Sections:
 - 1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, [and firestopping] for placement by this section.
 - 2. Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.
 - 3. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
 - 4. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
 - 5. Section 23 21 16 - Hydronic Piping Specialties: Product and execution requirements for piping specialties used in heating and cooling piping systems.
 - 6. Section 23 25 00 - 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 B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - 3. ASME B31.1 - Power Piping.
 - 4. ASME B31.9 - Building Services Piping.
 - 5. ASME BPVC 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 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 B88 - Standard Specification for Seamless Copper Water Tube.
 - 8. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 9. ASTM F2389 – Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.
- C. American Welding Society:
 - 1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP-67 - Butterfly Valves.

2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.
- B. Pipe sizes indicated on drawings are based on ASTM B88 Type L copper tubing and ASTM A53/A53M, Schedule 40 steel pipe. For non-metallic pipe, contractor to verify nominal pipe size for equivalent pressure drop, flow rate, and velocity.
- C. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever joining dissimilar metals in open systems.
- D. Provide flanges, union, and couplings at locations requiring servicing. 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.
- E. Provide pipe hangers and supports in accordance with MSS SP-69.
- F. Use ball or butterfly valves, as indicated on Drawings, for shut-off and to isolate equipment, part of systems, or vertical risers.
- G. Use globe, ball, or butterfly valves, as indicated on Drawings, for throttling, bypass, or manual flow control services.
- H. Use spring loaded check valves on discharge of hydronic pumps.
- I. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.
- J. Flexible Connectors: Use at or near pumps, compressors, and other motor driven equipment where piping configuration does not absorb vibration. The coupling shall be placed in close proximity to the source of the vibration.

1.4 SUBMITTALS

- A. Product Data – Polypropylene-Random Piping:
 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.
- B. Welders' Certificate: Include welders' certification of compliance with ASME BPVC Section IX, AWS D1.1/D1.1M, or equivalent.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of valves, equipment and accessories.
- B. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.
- C. Pressure Test Report: Submit verification of pressure test report. Include test type, testing pressure, and length of time.
 1. PP-R: Provide completed test report for Manufacturer's standard testing procedure.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

- B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME BPVC Section IX for welding materials and procedures.
- C. Perform Work in accordance with AWS D1.1/D1.1M for welding hanger and support attachments to building structure.
- D. All casings used for coupling housing, fittings, valve bodies, and specialties shall be date-stamped for quality assurance and traceability.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience .
- B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. 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. Polypropylene-Random Piping:
 - 1. Furnish ten year manufacturer warranty for piping, fittings, and any incidental damage caused by material failure from manufacturer defect.
 - 2. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or workmanship.
 - 3. Manufacturer's pressure testing procedure shall be followed to validate the warranty.

PART 2 PRODUCTS

2.1 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, cut or rolled grooved ends.
 - 1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, or ASTM A234/A234M carbon steel, grooved ends.
 - a. Where cast or wrought pattern is not available, factory-fabricated fittings from ASTM A53/A53M steel pipe may be used. Fittings shall be factory grooved and tested.
 - b. Victaulic No. V10, or equal: 90-degree elbow.
 - c. Victaulic No. V11, or equal: 45-degree elbow.
 - d. Victaulic No. V20, or equal: Straight tee.
 - 2. Victaulic Installation-Ready fittings for Schedule 10 through Schedule 80 plain end carbon steel piping in HVAC and mechanical applications, sizes NPS ½" through 2". System rated for a working pressure of 300 psi. Fittings shall consist of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready ends orange enamel coated or zinc coated. Fittings shall be provided complete with gasket liner, zinc-electroplated steel bolts and nuts as per the

mechanical properties of ASTM A449, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic SD.

3. Joints: Grooved mechanical couplings.
 4. Joints: Push-fit complying with NSF 61 and ASSE 1061. Crimping tool approved by Manufacturer and local Authority Having Jurisdiction. For pipe sizes 3/8 to 2 inches only.
- B. 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 degrees F.
- C. Polypropylene-Random (PP-R):
1. Manufacturers:
 - a. Niron (Nupi Americas, Inc.).
 - b. Uponor.
 2. Pipe: ASTM F2389, three-layer extrusion, including fiber layer (faser), standard dimension ratio SDR 11.
 3. Fittings: ASTM F2389, PP-R.
 4. Joints: Fusion-weld, including socket-fusion, electrofusion, or butt-fusion.
 5. Valves: ASTM F2389, PP-R.
 6. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
 - a. Flame Spread Classification: Less than 25.
 - b. Smoke Development Rating: Less than 50.
 7. UV Protection: Pipe to be exposed to directly sunlight for more than 30 days shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.
 8. Integral Thermal and Vapor Barrier: ASTM E84, UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.
 - a. Up to 1 inch of required insulation: Factory-installed, thermal and vapor barrier insulation shall be provided.
 - b. Over 1 inch of required insulation: Additional overlap of factory-installed, thermal and vapor barrier insulation shall be provided.
 - c. Thick-wall, self-insulating fittings: Do not require an additional vapor barrier.
 - d. See Section 23 07 00 for insulation requirements.

2.2 CHILLED WATER PIPING, ABOVE GROUND

- A. Steel Pipe: ASTM A53/A53M Schedule 40, black, cut or rolled grooved ends.
1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, or ASTM A234/A234M carbon steel.
- B. 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 degrees F.
- C. Polypropylene-Random (PP-R):
1. Manufacturers:
 - a. Niron (Nupi Americas, Inc.).
 - b. Approved equal.
 2. Pipe: ASTM F2389, three-layer extrusion, including fiber layer (faser), standard dimension ratio SDR 11 or SDR 17.6.
 3. Fittings: ASTM F2389, PP-R.
 4. Joints: Fusion-weld, including socket-fusion, electrofusion, or butt-fusion.
 5. Valves: ASTM F2389, PP-R.
 6. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.

- a. Flame Spread Classification: Less than 25.
 - b. Smoke Development Rating: Less than 50.
- 7. UV Protection: Pipe to be exposed to directly sunlight for more than 30 days shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.
- 8. Integral Thermal and Vapor Barrier: ASTM E84, UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.
 - a. Up to 1 inch of required insulation: Factory-installed, thermal and vapor barrier insulation shall be provided.
 - b. Over 1 inch of required insulation: Additional overlap of factory-installed, thermal and vapor barrier insulation shall be provided.
 - c. Thick-wall, self-insulating fittings: Do not required an additional vapor barrier.
 - d. See Section 23 07 00 for insulation requirements.

2.3 UNIONS 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.
 - 3. Dielectric Connections: Dielectric union connections are NOT permitted.
 - 4. PVC Piping: PVC.
 - 5. CPVC Piping: CPVC.
 - 6. PP-R Piping: PP-R
- B. 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.
 - 3. PVC Piping: PVC flanges.
 - 4. CPVC Piping: CPVC flanges.
 - 5. PP-R Piping: PP-R flanges.
 - 6. 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. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

2.4 DIELECTRIC FITTINGS:

- A. Dielectric Waterway Connectors:
 - 1. Manufacturers:
 - a. ClearFlow (Elstel Perfection).
 - b. Victaulic.
 - 2. Dissimilar metals shall be separated with a dielectric waterway connector.
 - 3. Material: Electro-zinc-plated steel casing, insert plastic lining, threaded ends.
- B. Dielectric Waterway: Fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service. Fittings shall have threaded ends, grooved ends, or a combination. Basis of Design: Victaulic Style 647.

2.5 MECHANICAL GROOVED COUPLINGS

- A. Manufacturers:
 - 1. Victaulic.
 - 2. Anvil Gruvlock.
 - 3. Grinnell.

- B. Ferrous piping, 2 through 12 inches:
1. Rigid Type: QuickVic couplings for pipe prepared with the Victaulic Original Grooved System (OGS) groove profile, sizes 2" through 12", consisting of two ductile iron housing segments conforming to ASTM A536 Grade 65-45-12, orange coated or hot dipped galvanized as per ASTM A123, center-leg gasket, and ASTM A449 and A563 compliant zinc-electroplated carbon steel or ASTM F593 and F594 compliant stainless steel (with galling reducing coating) bolts and nuts. Installation-Ready, for direct stab installation without field disassembly. Suitable for a minimum working pressure of 400 psi with standard weight pipe.
 - a. Housings cast with torque-absorber and shift-limiting slant bolt pad design to provide piping system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9, and to prevent mis-assembly due to overshift. Basis of Design: Victaulic Installation-Ready Style 107V, or equal.
 - b. Housings cast with alignment indicator notch for visual proper alignment to adjoining fitting.
 - c. Gaskets shall be verified as suitable for the intended service, Grade EHP (EPDM) for water services, temperature range -30 degrees F to 250 degrees F.
 2. Flexible Type: For use in locations where vibration attenuation and stress relief are required. 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. Victaulic Style 177.
 - a. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 250 degrees F.
 - b. Accessories: Zinc-electroplated steel or stainless steel bolts, nuts and washers.
 3. AGS two-segment couplings for pipe sizes 14" and larger, with wide-width FlushSeal gasket and lead-in chamfer on housing key. Basis of Design: Victaulic Style W07 (rigid) and Style W77 (flexible).
 4. Compatibility: All materials shall be compatible with 35 percent propylene glycol.

2.6 BALL VALVES

- A. Manufacturers:
1. Crane Valve, North America.
 2. Hammond Valve.
 3. Milwaukee Valve Company.
 4. NIBCO, Inc.
 5. Stockham Valves & Fittings.
- B. 2 inches and Smaller: MSS SP-110, 400 psi WOG, one piece bronze body, chrome plated brass ball, regular port, Teflon seats, blow-out proof stem, solder or threaded ends lever handle.

2.7 BUTTERFLY VALVES

- A. Manufacturers:
1. Crane Valve, North America.
 2. Hammond Valve.
 3. Milwaukee Valve Company.
 4. NIBCO, Inc.
 5. Stockham Valves & Fittings.
 6. Victaulic.
- B. 2-1/2 inches and Larger: MSS SP-67, Class 150.
1. Body: Cast or ductile iron, wafer, lug or grooved ends, stainless steel stem, extended neck. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.
 2. Disc: Nickel-plated ductile iron.
 3. Seat: Resilient replaceable EPDM.
 - a. Pressure responsive for sizes through 12 inches.
 4. Handle and Operator: Infinite position lever handle with memory stop.

2.8 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 23 05 29.

PART 3 EXECUTION

3.1 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.
- D. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install pipe hangers and supports in accordance with Section 23 05 29.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. For non-metallic pipe, verify nominal pipe size for equivalent pressure drop, flow rate, and velocity.
- B. Install heating water piping in accordance with ASME B31.9 (and ASME B31.1 as applicable).
- C. Route piping parallel to building structure and maintain gradient.
- D. Install piping to conserve building space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.
 - 1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
 - 2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.
- G. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.
- H. Install pipe identification in accordance with Section 23 05 53.
- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with .
- 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.
- N. Valves: Install with stems upright or horizontal, not inverted.
- O. Insulate piping and equipment; refer to Section 23 07 00.

- P. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. 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. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

3.4 INSTALLATION – PP-R PIPING JOINTS

- A. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
- B. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
- C. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F2389 and the manufacturer's specifications.
- D. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

3.5 FIELD QUALITY CONTROL

- A. Final System Pressure Test: Test heating water piping system in accordance with ASME B31.9 (and ASME B31.1 as applicable).
 - 1. Test Type: Hydrostatic
 - 2. Minimum Testing Pressure: 1.5 times design pressure. Refer to Drawing Schedules.
 - 3. Maximum Testing Pressure: 100 psig.
- B. PP-R: Test piping system in accordance with the Manufacturer's standard testing procedure.

3.6 CLEANING

- A. As directed by Water Treatment Contractor. Refer to Section 23 25 00.

END OF SECTION

SECTION 23 21 16 – HYDRONIC PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pressure gages.
 - 2. Pressure gage taps.
 - 3. Thermometers.
 - 4. Thermometer supports.
 - 5. Test plugs.
 - 6. Flexible connectors.
 - 7. Air vents.
 - 8. Strainers.
 - 9. Flow controls.
 - 10. Relief valves.
 - 11. Glycol solution.
- B. Related Sections:
 - 1. Section 23 21 13 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.
 - 2. Section 23 25 00 – HVAC Water Treatment: Execution requirements for pipe cleaning.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B40.100 - Pressure Gauges and Gauge Attachments.
 - 2. ASME BPVC Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- B. ASTM International:
 - 1. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.
 - 2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- C. American Water Works Association:
 - 1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 - 2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
 - 3. AWWA C702 - Cold-Water Meters - Compound Type.
 - 4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 - 5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- D. Underwriters Laboratories Inc.:
 - 1. UL 393 - Standard for Indicating Pressure Gauges for Fire-Protection Service.
 - 2. UL 404 - Standard for Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. Flexible Connectors: Provide at or near pumps and other motorized equipment where piping configuration does not absorb vibration.

1.5 SUBMITTALS

- A. Product Data: Submit for manufactured products and assemblies used in this Project.
 - 1. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.

2. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
3. Submit electrical characteristics and connection requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of actual locations of components and instrumentation, flow controls.
- B. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.7 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. 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.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

- A. Manufacturers:
 1. Ashcroft, Inc.
 2. H. O. Trerice Company.
 3. Weiss Instruments, Inc.
- B. Gage: ASME B40.100, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 1. Case: Fiberglass reinforced polypropylene.
 2. Bourdon Tube: Brass.
 3. Dial Size: 4-1/2 inch diameter.
 4. Mid-Scale Accuracy: One percent.
 5. Units of Measure: Both psi and kPa.
 6. Range: 0 through 100 psi.

2.2 PRESSURE GAGE TAPS

- A. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

2.3 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Ashcroft, Inc.
 - 2. H. O. Trerice Company.
 - 3. Weiss Instruments, Inc.
- 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, Length as required for proper fluid sensing.
 - 4. Accuracy: 2 percent.
 - 5. Units of Measure: Both °F and °C.
 - 6. Range:
 - a. Hot Water: 30°F to 240°F.
- C. Light-Powered Digital Thermometer: NEMA-4X, adjustable angle, LCD digits display, cast aluminum case with epoxy finish, cast aluminum adjustable joint with positive locking device.
 - 1. Size: 7 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Stem: Brass, 3/4 inch NPT, Length as required for proper fluid sensing.
 - 4. Accuracy: 1 percent.
 - 5. Units of Measure: Both °F and °C.
 - 6. Range:
 - a. Hot Water: 30°F to 240°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.

2.5 TEST PLUGS

- A. 1/4 inch NPT or 1/2 inch NPT brass 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.

2.6 FLEXIBLE CONNECTORS

- A. Minimum 9 inches long with copper tube ends; for maximum working pressure 300 psig.
 - 1. Rigidly Mounted Pumps: Corrugated stainless steel hose with single layer of stainless steel exterior braiding.
 - 2. Pumps with Inertia Bases: Double-sphere neoprene rubber.
 - 3. Three Victaulic flexible type couplings may be used in lieu of a flexible connector for vibration attenuation at equipment connections. The couplings shall be placed in close proximity to the source of vibration.

2.7 AIR VENTS - MANUAL

- A. Manufacturers:
 - 1. Refer to Ball Valves in Section 23 21 13.

- B. Manual Type:
 - 1. Short vertical section of pipe to form air chamber, with 1/2 inch brass ball valve with threaded hose end at top of chamber.
 - 2. Application: All locations except at Air Separators.
 - 3. Contractors Option: 3/4 inch brass ball valve

C. **NOTE: Coin-operate air vents are not acceptable.**

2.8 STRAINERS

- A. Size 2 inch and Smaller:
 - 1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 2-1/2 inch to 4 inch:
 - 1. Flanged or grooved iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.9 FLOW CONTROL VALVES

- A. Manufacturers:
 - 1. Bell & Gossett (Xylem, Inc.).
 - 2. Griswold Controls
 - 3. Taco, Inc.
 - 4. Victaulic Company.
- B. Construction: Brass or bronze body with union on inlet, and outlet, temperature and pressure test plug on inlet, and combination blow-down and back-flush drain.
- C. Calibration: Control within 5 percent of design flow over entire operating pressure.
- D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.
- E. Accessories: Ball valve on outlet.

2.10 RELIEF VALVES

- A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.11 GLYCOL SOLUTION

- A. Refer to Section 23 25 00.

PART 3 EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

- A. Install one pressure gage for each pump, locate taps as detailed on Drawings.
- B. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- C. 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.
- D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- E. Coil and conceal excess capillary on remote element instruments.
- F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

- G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

- A. Drain and reserve existing glycol solution, if any, and turn over to Owner.
- B. Install manual air vents at system high points.
- C. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- D. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- E. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- F. Pipe relief valve outlet to nearest floor drain.

3.3 CLEANING

- A. Refer to Section 23 25 00.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION

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SECTION 23 25 00 – HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. System cleaner.
 - 2. Closed system treatment (water).
 - 3. Glycol solution.
- B. Related Sections:
 - 1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
 - 2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections specified by this section.

1.2 REFERENCES

- A. NONE

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.
- B. System cleaning to be done under the direction of Water Treatment Contractor (WTC).
- C. Glycol solution to be provided by Mechanical Contractor.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide system to treat water available at project site to maintain the following characteristics of water in closed systems:
 - 1. Hardness: 7 grains or less.
 - 2. Iron: Per equipment and piping manufacturers' requirements.
 - 3. Total Dissolved Solids: Per equipment and piping manufacturers' requirements.
 - 4. Total Alkalinity: Per equipment and piping manufacturers' requirements.
 - 5. Silica: Per equipment and piping manufacturers' requirements.
 - 6. pH: Per equipment and piping manufacturers' requirements.

1.5 SUBMITTALS

- A. Product Data: Submit chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
- B. Glycol Solution Test: Provide written test of glycol solution strength.

1.7 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with Authority Having Jurisdiction standard for addition of non-potable chemicals to building systems and for discharge to public sewers.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience with water analysis laboratories and full time service personnel.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SYSTEM CLEANER

- A. Product Description: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.
- B. Provided by Mechanical Contractor.

2.2 CLOSED SYSTEM TREATMENT (WATER)

- A. Sequestering agent to reduce deposits and adjust pH.
 - 1. Corrosion inhibitors: Nitrate-based solutions.

2.3 GLYCOL SOLUTION

- A. Inhibited propylene glycol and water solution mixed 35 percent glycol and 65 percent dilution water, suitable for operating temperatures from -30 degrees F to 250 degrees F.
 - 1. Contractor is responsible for confirming exact glycol/water dilution prior to filling.

PART 3 EXECUTION

3.1 PREPARATION

- A. Drain and reserve existing glycol solution, if any, and turn over to Owner.
- B. Operate, fill, start and vent systems prior to cleaning.
- C. Use water meter to record capacity in each system.
- D. Place terminal control valves in open position during cleaning.
- E. Flush system of dirt and debris.

3.2 FIELD QUALITY CONTROL

- A. Mechanical Contractor to test for strength of glycol and dilution water solution and submit written test results.

3.3 CLEANING

- A. Concentration:
 - 1. As recommended by manufacturer.
- B. Hot Water Heating Systems:
 - 1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
 - 2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
 - 3. Circulate for 6 hours at design temperatures, then drain.
 - 4. Refill with clean water and repeat until system cleaner is removed.

- C. Use neutralizer agents on recommendation of system cleaner supplier and acceptance of Architect/Engineer.
- D. Remove, clean, and replace strainer screens and side-stream filter cartages.
- E. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.4 INSTALLATION

- A. Once cleaning is finished and approved, feed glycol solution to system with make-up system with pressure regulator, venting system high points.

END OF SECTION

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SECTION 23 31 00 – HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Duct Materials.
 - 2. Insulated flexible ducts.
 - 3. Single wall longitudinal-seam round ducts.
 - 4. Single wall spiral-seam round ducts.
 - 5. Transverse duct connection system.
 - 6. Ductwork fabrication.
- B. Related Sections:
 - 1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
 - 2. Section 23 33 00 - 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 A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - 3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Air Duct Leakage Test Manual.
 - 2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- D. Underwriters Laboratories Inc.:
 - 1. UL 181 - Standard for Factory-Made Air Ducts and Connectors.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 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.

1.5 SUBMITTALS

- A. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- C. Construct ductwork to NFPA 90A (as well as NFPA 90B and NFPA 96 as applicable) standards.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.
- B. Fasteners: Rivets, bolts, or sheet metal screws.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. Finish: Paintable for exposed, uninsulated duct.

2.2 INSULATED FLEXIBLE DUCTS

- A. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
 - 1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 - 2. Maximum Velocity: 4000 fpm.
 - 3. Temperature Range: -10 degrees F to 160 degrees F.
 - 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.3 SINGLE WALL LONGITUDINAL-SEAM ROUND DUCTS

- A. Product Description: UL 181, Class 1, round longitudinal snaplock seam duct constructed of galvanized steel.
- B. Longitudinal seam ducts are only allowed for 14-inch or smaller diameter ducts for 2-inch or less duct pressure classifications.

2.4 SINGLE WALL SPIRAL ROUND DUCTS

- A. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.
- B. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

- C. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.5 TRANSVERSE DUCT CONNECTION SYSTEM

- A. Product Description: SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
- B. Spiral Duct Product Description: 16-gauge flange system with barrel clamp and bolt lock systems and neoprene gasket.

2.6 DUCTWORK FABRICATION

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION - GENERAL

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.
- D. Install duct hangers and supports in accordance with Section 23 05 29.
- E. Use double nuts and lock washers on threaded rod supports.
- F. Connect flexible ducts to metal ducts with draw bands and adhesive.
- G. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.
- H. All takeoffs shall be pre-manufactured high efficiency with integral volume damper and neoprene gasket flange seal.
- I. Seam and joint sealing:
 - 1. Seam duct seams and joints according to SMACNA - HVAC Duct Construction Standards - Metal and Flexible for duct pressure class indicated.
 - 2. Seal all transverse joints, longitudinal joints, and duct penetrations.
 - 3. Seal to achieve no visible or audible leaks.
 - 4. Seal externally insulated ducts before insulation is applied.
 - 5. Seal exposed joints internally during installation. Do not use external sealant on exposed ducts
 - 6. Outside air and exhaust/relief air ducts shall be sealed water-tight and sloped to drain.
 - 7. MINNESOTA: Ducts shall be sealed to meet MN Rules 1346.0603. Pressure sensitive tape shall **NOT** be used as the primary sealant.
- J. Where ductwork penetrates floor, ceiling, or wall, close off space between duct and adjacent work with insulation and caulk airtight. Provide close fitting metal collar at both sides of penetration.
 - 1. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around duct penetration. Match materials and finishes of adjacent work.
- K. Install firestopping at fire rated construction perimeters and openings containing penetrating ductwork. Refer to Section 23 05 29 and Division 07.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- C. Connect air terminal units, air outlets, and air inlets to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.4 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.5 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply	Refer to Drawings for system external static pressure. Pressure class to not be less that equipment external static pressure.
Return and Relief	1 inch wg regardless of velocity.
General Exhaust	1 inch wg regardless of velocity.

END OF SECTION

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SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Duct access doors.
 - 2. Volume control dampers.
 - 3. Back-draft dampers.
 - 4. Flexible duct connections.
 - 5. Control air dampers.
 - 6. Duct-mounted smoke detectors.
- B. Related Sections:
 - 1. Section 23 09 00 - Instrumentation and Control for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
 - 2. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
 - 3. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Laboratory Methods of Testing Louvers for Rating.
- B. ASTM International:
 - 1. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.
- C. 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.
- 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 Fire Dampers.
 - 2. UL 555C - Standard for Ceiling Dampers.
 - 3. UL 555S - Standard for Smoke Dampers.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of access doors and test holes.

1.5 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Dampers tested, rated and labeled in accordance with the latest UL requirements.
- C. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.
- B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- C. Storage: Store materials in a dry area indoor, protected from damage.
- D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Coordinate Work where appropriate with building control Work.

1.10 WARRANTY

- A. Furnish one year manufacturer warranty for duct accessories.

PART 2 PRODUCTS

2.1 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2.2 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
- C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.
- D. Quadrants:
 - 1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.3 BACK-DRAFT DAMPERS

- A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

- B. Per 2020 Minnesota Energy Code: Provide back-draft dampers for all exhaust fan systems with airflow less than 300-cfm.

2.4 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and [as indicated on Drawings.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 6 inches wide.
 - 3. Metal: 3 inch wide, 24 gage galvanized steel.

2.5 CONTROL AIR DAMPERS

- A. Performance: Test in accordance with AMCA 500.
- B. Per 2020 Minnesota Energy Code: Provide motorized 2-position or modulating control air dampers for all exhaust fan systems with airflow equal to or greater than 300-cfm.
- C. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.
 - 1. Outdoor/Relief Applications: Insulated, thermally-broken frame.
- D. Blades: Galvanized steel, maximum blade size 48 inches wide, 48 inches long, minimum 22 gage, attached to minimum 1/2 inch shafts with set screws.
- E. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.
- F. Jamb Seals: Stainless steel spring.
- G. Shaft Bearings: Graphite impregnated nylon sleeve, with thrust washers at bearings.
- H. Linkage Bearings: Graphite impregnated nylon.
- I. Air Damper Leakage:
 - 1. Outside/Relief Damper: Maximum leakage rate of 3.0 cfm per square foot at 1.0 inches wg pressure differential.
 - 2. General Damper: Less than one percent based on approach velocity of 2000 fpm and 4 inches wg.
- J. General Damper Leakage: Maximum leakage rate of 1 percent at 4.0 inches wg pressure differential.
- K. Damper Leakage: Less than one percent based on approach velocity of 2000 fpm and 4 inches wg.
- L. Maximum Pressure Differential: 6 inches wg.
- M. Temperature Limits: - 40 to 200 degrees F.

2.6 DUCT-MOUNTED SMOKE DETECTOR

- A. Refer to Drawing Schedules. Refer to Division 28.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rated walls are ready for fire damper installation.
- B. Verify ducts and equipment installation are ready for accessories.
- C. Check location of air outlets and inlets and make necessary adjustments in position to 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. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.
- C. Access Doors: Install access doors at the following locations and as indicated on Drawings:
 - 1. Upstream and downstream of each reheat coil, including VAV boxes.
 - 2. Before and after each automatic control damper.
 - 3. Before and after each fire damper, smoke damper, and combination fire and smoke damper.
- D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

3.3 DEMONSTRATION

- A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 36 00 – AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Variable volume terminal units.
- B. Related Sections:
 - 1. Section 23 09 00 - Instrumentation and Control for HVAC: Product requirements for control components to interface with air terminal units.
 - 2. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
 - 3. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
 - 4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections to air terminal units specified by this section.

1.2 REFERENCES

- A. Air-Conditioning, Heating, & Refrigeration Institute:
 - 1. AHRI 880 - Performance Rating of Air Terminals.
 - 2. AHRI 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 - Standard for Factory-Made Air Ducts and Connectors.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.
- B. All single-duct variable-volume terminal units in this project scope of work are existing for re-use or relocation per contract documents. Existing sequences of operation to remain with associated air-handling systems and revised zone temperature controls.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of units and controls components.
- B. 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. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Test and rate air terminal units performance for air pressure drop, flow performance, and acoustical performance in accordance with AHRI 880 and AHRI 885. Attach AHRI seal to each terminal unit.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 COORDINATION

- A. Coordinate Work with Section 23 09 00 - HVAC Instrumentation and Controls.

PART 2 PRODUCTS

2.1 SINGLE DUCT VARIABLE VOLUME AIR TERMINAL UNITS (EXISTING EQUIPMENT FOR RE-USE)

- A. Product Description: Variable air volume terminal units for connection to central air systems, with electronic controls, and ,hot water heating coils.
- 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 gage galvanized steel.
 - 2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated glass fiber insulation, 1.5 lb./cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements with solid metal liner over insulation.
 - 3. Access Panels: Refer to 23 33 00.
- D. Basic Unit:
 - 1. Configuration: Air volume damper assembly inside unit casing. Locate 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 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, factory installed.
 - 2. Capacity: Refer to Drawings.
 - 3. Provide access doors in VAV unit or adjacent ductwork for access both upstream and downstream of heating coil for cleaning.
- F. Airflow Sensor:
 - 1. Cross configuration located at the unit inlet.
 - 2. Sensor shall have pressure sensing ports for averaging unit air flow.
 - 3. Sensor shall provide accuracy within 5 percent.
- G. Thermostat: Electronic type with appropriate mounting hardware. Refer to Section 23 09 00.
- H. Direct Digital Controls shall be provided by Temperature Controls Contractor.
 - 1. Sequence of Operation: Refer to Section 23 09 93.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify ductwork is ready for air terminal installation.

3.2 INSTALLATION

- A. Connect to ductwork in accordance with Section 23 31 00.

- 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.
- 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.

3.3 ADJUSTING

- A. Temperature Controls Contractor: Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to minimum flow, as indicated in Drawing Schedules.

END OF SECTION

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SECTION 23 82 16 – AIR COILS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Finned tube radiation.
 - 2. Chilled beams.
- B. Related Sections:
 - 1. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
 - 2. Section 23 21 13 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, and drain piping to units specified by this section.
 - 3. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.

1.2 REFERENCES

- A. Air-Conditioning, Heating, & Refrigeration Institute:
 - 1. AHRI 440 – Performance Rating of Room Fan-Coils.
 - 2. AHRI 840 – Standard for Unit Ventilators.
- B. Underwriter Laboratories Inc.:
 - 1. UL 1995 – Heating and Cooling Equipment.

1.3 SYSTEM DESCRIPTION

- A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

- A. 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
- B. 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.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.
- B. Operation and Maintenance Data: Submit manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

- A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.
- B. Fan Coil Units: Conform to AHRI 440 and UL 1995.
- C. Unit Ventilators: Conform to AHRI 440, AHRI 840, and UL 1995.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept units on site in factory packing. Inspect for damage. Store under roof.
- B. 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.

1.9 FIELD MEASUREMENTS

- A. Induction unit filler panels: Verify room dimensions prior to order and installation.
- B. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 FINNED TUBE RADIATION

- A. Manufacturers:
 - 1. Rittling (Zehnder Group).
 - 2. SIGMA Corporation.
 - 3. Sterling Hydronics (Mestec, Inc.).
 - 4. Trane, Inc. (Ingersoll-Rand, Inc.).
 - 5. Vulcan Radiator (Mestec, Inc.).
- B. Heating Elements: Seamless copper tubing, mechanically expanded into evenly spaced aluminum fins, suitable for soldered fittings.
 - 1. Tubing and fin to be sized to meet required capacity per Drawings.
- C. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
- D. Enclosures: 0.0478 inch thick steel up to 18 inches in height, 0.598 inch steel over 18 inches in height, with easily jointed components for wall to wall installation. Support rigidly, on wall or floor mounted brackets [at least 3 feet on center maximum].
 - 1. Style: Refer to Drawing Schedules.
- E. Finish: Factory applied baked enamel. Coordinate with Architect for color.
- F. Access Doors: For otherwise inaccessible valves, furnish factory-made permanently hinged access doors, 6 x 7 inch minimum size, integral with cabinet.
- G. Capacity: Refer to Drawings, based on 65 degrees F entering air temperature, 145 degrees F average water temperature.

2.2 CHILLED BEAM

- A. Manufacturers:
 - 1. Titus HVAC.
 - 2. TROX USA, Inc. (TROX Technik).
 - 3. Price Industries.
 - 4. Dadanco.
- B. Configuration: Ceiling mounted, 24-inch-wide active chilled beam with horizontal coil, two-way throw, lay-in border.
- C. Cabinet Enclosures:
 - 1. 20 gauge, G90 galvanized steel.
 - 2. Fabricate cabinet enclosures complete with mounting brackets, hinged return face, and discharge grills.

- 3. Finish is powder coat.
- 4. Internal casing painted black.
- D. Return Face Panel: Linear bar grille, pencil proof.
- E. Cooling Coil: 1/2" connections with air vent.
- F. Performance:
 - 1. Refer to Drawings.
 - 2. Noise Criteria: NC-27.

PART 3 EXECUTION

3.1 EXAMINATION

- A. For induction units, verify shelving and filler panels are correct size.
- B. For recessed units, verify recess dimensions are correct size.
- C. Verify wall construction is ready for installation.
- D. Verify ductwork is ready for installation.
- E. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

- A. Install air coils in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible. Refer to Section 23 31 00.
- B. Support air coil sections independent of piping on steel channel or double angle frames and secure to casings. Install with airtight seal between coil and duct or casing.
- C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- D. Install coils level.
- E. Make connections to coils with unions and flanges.
- F. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window. Align cabinet joints with window mullions. Install wall angles where units butt against walls.
- G. Chilled Beams: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount height to be flush with ceiling.
- H. Protection: Install finished cabinet units with protective covers during remainder of construction.
- I. Units with Cooling Coils: Install drain piping to condensate drain. Refer to Section 23 21 13.

3.3 CARBON MONOXIDE ALARMS

- A. Install carbon monoxide (CO) alarms in all new and existing rooms containing a fuel-burning appliance per 2020 Minnesota Mechanical and Fuel Gas Code. CO alarms shall be UL 2034 listed.

3.4 INSTALLATION – HYDRONIC COILS

- A. On water coils, refer to Drawing Details for piping connections and accessories. Refer to Section 23 21 13.
 - 1. Induction Units: For multiple unit configurations, install coil accessories according to Drawings.
- B. On water coils, connect water supply piping to leaving airside of coil (counter flow arrangement). Refer to Section 23 21 13.

- C. On refrigerant coils, install sight glass in liquid piping within 12 inches of coil. Refer to Section 23 23 00.
- D. Insulate headers located outside airflow, insulate as specified for piping. Refer to Section 23 07 00.
- E. Hydronic Units: Refer to Drawing Details for piping connections and accessories. Refer to Section 23 21 13.

3.5 CLEANING

- A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- C. Install new filters.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Section Includes, but not limited to:
 - 1. General Requirements for Electrical
 - 2. Equipment and Materials
 - 3. General Workmanship and Installation Requirements for Electrical.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 01 Specification Sections apply to this Section.
- B. Division 26: Electrical
- C. Division 28: Electronic Safety and Security.
- D. When a Specification Section refers to other Sections under the Article on Related Sections, this is for Contractor's convenience. It shall in no way relieve the Contractor of responsibilities stated in other Sections of the Specifications, even though these Sections are not referenced. The Contractor is responsible for all information contained in this Division's Specifications as well as for information contained in all other Divisions.

1.3 ALTERNATES

- A. Refer to Bid Form and Instruction to Bidders.

1.4 REGULATORY REQUIREMENTS

- A. Meet or exceed all current applicable codes, ordinances, and regulations for all installations. Promptly notify the Engineer, in writing, if the contract documents appear to conflict with governing codes and regulations. The contractor assumes all responsibility and costs for correcting non-complying work installed without notifying the Engineer.
- B. Higher quality of workmanship and materials indicated in the Contract Documents takes precedence over that allowed in referenced codes and standards.
- C. Perform all work in compliance with the currently adopted version of the following codes and standards for this project:
 - 1. Energy Codes and Standards:
 - a. International Energy Conservation Code (IECC)
 - b. Illuminating Engineering Society of North America (IESNA)
 - c. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE 90.1)
 - 2. International Code Council:
 - a. International Building Code (IBC)
 - b. International Fire Code (IFC)
 - 3. National Fire Protection Association Codes and Standards:
 - a. NFPA 70 - National Electrical Code
 - b. NFPA 72 - Fire Alarm Code
 - c. NFPA 101 - Life Safety Code
 - 4. National Electrical Safety Code (ANSI C2)

5. City, State and Local Building Codes and Ordinances
6. City, State and Local Fire Codes and Regulations
7. Occupational Safety and Health Administration Regulations (OSHA)
8. Americans with Disabilities Act (ADA)
9. Uniform Federal Accessibility Standards
10. State Department of Health Codes and Regulations
11. Testing Agencies:
 - a. Underwriters Laboratory
 - b. Intertek ETL

1.5 REFERENCES

- A. Use the latest edition of the standard or the edition required by governing code were referenced in the specifications by the following abbreviations:
 1. ANSI American National Standards Institute:
 - a. C2 - National Electrical Safety Code.
 - b. C62.41-IEEE - Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 2. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
 3. CBM – Certified Ballast Manufacturer
 4. EPA-Environmental Protection Agency
 5. ETL – Electrical Testing Laboratory
 6. ICEA - Insulated Cable Engineers Association:
 - a. S-95-658 - Thermoplastic-Insulated Wire and Cable.
 - b. S-65-375 - Rubber-Insulated Wire and Cable.
 7. IEEE Institute of Electrical and Electronic Engineers:
 - a. 112 - Standard Test Procedure for Polyphase Induction Motors and Generators.
 - b. 519 - Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.
 8. IES - Illuminating Engineering Society
 9. NBFU - National Board of Fire Underwriters
 10. NECA – National Electrical Contractor’s Association:
 - a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
 11. NEC - National Electrical Code
 12. NECA – National Electrical Contractors Association:
 - a. NECA 101 – Standard for Installing Steel Conduit
 - b. NECA 102 – Standard for Installing Aluminum Rigid Metal Conduit.
 - c. NECA 111 – Standard for Installing Nonmetallic Raceways (RNMIC).
 13. NEMA National Electrical Manufacturers Association:
 - a. TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - b. MG 1 - Motors and Generators.
 - c. PB 2 - Deadfront Distribution Switchboards.
 - d. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2,000 Volts AC or 750 Volts DC.
 - e. 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - f. WC 5 - (See ICEA S-95-658).
 - g. WC 7 - (See ICEA S-95-658).
 14. NESC – National Electric Safety Code
 15. NFPA National Fire Protection Association
 16. OSHA Occupational Safety and Health Administration:
 - a. 29 CFR 1910 - Occupational Safety and Health Standards.

17. UL Underwriters' Laboratories, Inc.:
 - a. UL-6 - Rigid Metal Conduit.
 - b. UL-83 - Thermoplastic - Insulated Wires and Cables.
 - c. UL-360 - Liquid-Tight Flexible Steel Conduit.
 - d. UL-467 - Electrical Grounding and Bonding Equipment.
 - e. UL 486D - Insulated Wire Connector Systems for Underground Use or In Damp or Wet Locations.
 - f. UL-508 - Industrial Control Equipment.
 - g. UL-651 - Schedule 40 and 80 Rigid PVC Conduit.
 - h. UL-797 - Electrical Metallic Tubing.
 - i. UL-891 - Dead-Front Switchboards.
 - j. UL-1008 - Transfer Switch Equipment.
 - k. UL-1012 - Power Units Other Than Class 2.
 - l. UL-1277 - Electrical Power and Control Tray Cables With Optional Optical Fiber Members
 - m. UL-1449 - Surge Protection Devices
 - n. UL-1479 - Fire Tests of Through-Penetration Firestops.

1.6 DEFINITIONS

- A. The terms defined below apply to all work included in Division 26.
 1. 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.
 2. Furnish: to obtain in new condition ready for installation into the work.
 3. Install: to store, set in place, connect, and place into operation into the work.
 4. Provide: to furnish and install.
 5. Connect: to bring service to the equipment and make final attachments including necessary switches, outlets, boxes, terminations, or other final connections.
 6. Conduit: in addition to conduit raceways; includes all fittings, pull boxes, hangers, supports, accessories, and all work related to such conduit.
 7. Concealed: hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
 8. Exposed: not installed underground nor concealed as defined above.
 9. Underground: below finished grade or surface exterior of a building, outside of the building foundation.
 10. Under or Below Floor: below the finished floor inside the foundations or footprint of a building.
 11. Building structure or building structural members - consists of steel columns, steel beams, steel joists (top chord and at panel points), concrete walls and concrete block walls. Metal decking, joist bridging, and bottom chords of bar joists shall not be construed as building structure nor as a building structural member for the purpose of support.
 12. SCADA: supervisory control and data acquisition. Includes all control system programable components, software, visual displays, operator interaction devices, control panels, communications, telemetry and all other associated equipment for data acquisition, transmission, processing, monitoring, control, analysis, display, and alarming for an operating and specified control system.
- B. The drawing and specifications constitute the Contract Documents. Any item noted in the specification or shown on the drawings is part of the Contract Documents.

1.7 CONTRACTOR RESPONSIBILITIES

- A. Regulatory Requirements:
 - 1. Initiate, maintain, and supervise all safety precautions required with this work in accordance with the regulations of the Occupational Safety and Health Administration (OSHA) and other governing agencies.
- B. Environmental Requirements:
 - 1. Do not remove or disturb any asbestos containing materials from the project. Immediately stop work and notify the Owner if asbestos containing materials are suspected.
 - 2. Do not dispose of any PCB containing materials. Disposal of all PCB containing materials will be the responsibility of the Owner.
- C. Provide new, first quality material for all products specified. Do not reuse materials unless indicated or approved by the Engineer.
- D. Provide equipment specified in this section which is listed and labeled by a nationally recognized testing laboratory.
- E. Comply with ANSI as applicable to equipment specified in this section.
- F. Comply with NEMA as applicable to equipment specified in this section.
- G. The contractor shall field-verify all dimensions and notify the Engineer or Owner Representative of any conflicts or discrepancies, in writing, prior to submittals and installation. If prior notification is not provided, Contractor is responsible for resolution of all dimensional conflicts.
- H. The contractor is responsible for all revisions and changes required to any work needed for compliance with the national electrical code. This includes work to accommodate equipment which was approved as an equal, equipment or work Contractor provided which was not approved but later accepted, work already completed, or any other proposed adjustments to the Contract. Engineer approval of work, submittals, equipment, equals, work changes, or any other contract modifications does not grant the Contractor approval to exclude other work needed to ensure electrical code is still being met.
- I. Equipment provided with SCCR ratings/labels shall be provided with sufficient SCCR values to exceed the available short circuit current at the equipment connection point. Where short circuit current is not identified in the Contract Documents, the contractor is responsible for providing the necessary calculations for coordination.
- J. Include better quality, greater quantity or higher cost for an item or arrangement where a disagreement exists in the drawings and specifications. If multiple different scenarios, situations, or materials are proposed for a single item or design case, include the cost of all work for scenarios and situations included in the Contract Documents, unless noted otherwise.
- K. The contractor shall have knowledge of the latest edition of NFPA 70 (NEC) and additional governing codes. In addition to the work shown in the Contract Documents, Contractor shall provide all work to comply with these references. If there is a conflict with the Contract Documents and such governing codes, the Contractor shall alert the Owner Representative during the bidding review period and prior to the final questions date. If the Contractor fails to do so, additional services will not be awarded to the Contractor to perform work to correct issues which are conflicting with governing code requirements nor to satisfy the AHJ inspection comments. All work is to be included in Base Bid or other work proposed to the Contract.

- L. Contractor shall notify Engineer or Owner Representative of issues or questions with ample time to allow Owner, Engineer, and designer to review and respond to the request before Contractor purchases and/or installs such equipment. By submitting a bid, the contractor agrees and acknowledges the Owner, Engineer, and Project Representative cannot and will not be held responsible for delays in the project or increases in costs due to Contractor failure to provide ample notice to allow review of and response to the potential issue. The acceptable duration of such ample notice will be determined by the Owner Representative, and duration will be based on the complexity of the request, however duration shall not at any time be expected to be less than 10 business days from the date the electrical Engineer of Record receives the request. In recognition of this, Contractor is to plan, coordinate and schedule construction accordingly. Failure to do so will result in a violation of the Contract.

1.8 PROJECT/SITE CONDITIONS

- A. Site Inspections:
 - 1. Before submitting a proposal on the work contemplated, examine the site of the proposed work, and become thoroughly familiar with existing conditions and limitations. No extra compensation will be allowed because of misunderstanding as to the amount of work involved nor the bidders' lack of knowledge of existing conditions which could have been discovered or reasonably anticipated prior to bidding.
 - 2. Raceways, pipes, ducts, lights, devices, speakers, etc., shown on the drawings as existing have been based on existing plans and casual site observations, and may not be installed as originally shown. It is the Contractor's responsibility to visit the site and make an exact determination of the existence, location, and condition of such facilities prior to submitting a bid.
- B. Correlation of Work:
 - 1. Consult the drawings and specifications of all other Divisions to correlate information and layout work so that it will coordinate with other trades. Verify dimensions and conditions (i.e., finished ceiling heights, footing and foundation elevations, beam depths, etc.) with all drawings. Notify the Engineer of any conflicts that cannot be resolved in the field by affected trades. Replacement of work due to lack of coordination and failure to verify existing conditions will be completed at no cost to the Owner.
 - 2. Install all conduits, cable tray, busduct, equipment, etc. allowing proper code and maintenance clearances to avoid blocking passageways and access panels.
 - 3. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no cost to the Owner. This applies to shop fabricated work as well as to work fabricated in place.
 - 4. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall perform adjustments without additional cost to the Owner, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.
 - 5. Obtain the exact location of connection to equipment, furnished by others, from the entity furnishing the equipment.
- C. The Contract Documents shall govern in the instances where requirements indicated are greater than those stated in the governing codes and standards.

1.9 FIRESTOPPING

- A. Provide firestopping around all new penetrations, sleeves and openings through all partitions, walls, and floors.
- B. Provide UL listed components installed by certified and factory trained personnel.

1.10 SEQUENCING AND SCHEDULING

- A. Refer to General Conditions and Requirements.

1.11 EQUIPMENT INSTRUCTIONS AND PARTS LITERATURE

- A. Instruction and parts literature are generally packed with electrical equipment and devices. Contractors shall remove this literature from the packing container or equipment enclosure, identify the literature with the equipment to which it applies, and file the literature in loose-leaf binders with index tabs. Each binder shall have an index which lists each piece of equipment and the literature which applies to it. An index tab shall be provided for each piece of equipment.
- B. Contractors shall establish a procedure with the other trades for receiving, identifying, and filing literature for devices which are removed from their packaging and installed by other trades.

1.12 SUBMITTALS

- A. Submit the following items consistent with Division 0 and Division 1. Refer to each Section under Division 26 for additional submittal requirements particular to that Section.
- B. Prior Approvals:
 - 1. Submit approval form for each request for prior approval.
 - 2. Submittals shall be formally presented to the Owner Representative. Submittals presented to the Engineer prior to approval of the Owner Representative will not be reviewed or accepted.
 - 3. Submit electronic, written requests to use unspecified items, to the Engineer, no later than ten (10) business days prior to the bid opening. Submit detailed information for proposed material or equipment specific to the project, clearly indicating all options included in the submittal.
 - 4. Accepted substitutions will be incorporated in an Addendum to the Contract Documents.
 - 5. The contractor is responsible for dimensional differences, electrical requirements, and any other resulting changes, when using accepted substitutions. The contractor is responsible for any additional costs incurred because of substitutions, including other contractors and Engineer fees.
 - 6. Material and equipment not specified or accepted in an Addendum will be removed and replaced at no cost or inconvenience to the Owner.
- C. Work Scope Change:
 - 1. If a work scope change is requested and the Contractor would like to be awarded additional compensation or a deduct from original contract is requested, Contractor shall provide a schedule of values for all associated proposed work.
 - a. Pricing shall be grouped to represent each itemized work scope change.
 - b. Each piece of equipment shall be itemized, along with the cost of item. Labor to install said item shall be presented on a separate line item.
 - c. Provide a final lump sum number for all work associated with the change and individual pricing for each item on the schedule of values.
 - d. Engineer may request additional breakdown for improved clarity and Contractor must comply prior approval for the additional compensation or credit.

- e. Comply with the requirements set forth in Division 0 and Division 1.
 - 2. The contractor shall provide actual manufacturer and distributor invoices or quotations showing the costs of material and work affected by the scope change upon request of the Engineer or Owner representative.
 - 3. Contractor is solely responsible for delays in schedule where Contractor is required to resubmit documentation, revise requested documentation or provide additional information associated to gaining approval for the work scope change.
- D. Shop Drawings and Manufacturer's Information:
- 1. Submit in accordance with Division 0 and Division 1. Unless noted otherwise, submit drawings to the Engineer for review within 30 calendar days after the award of Contract.
 - 2. Provide digital copy in a PDF format:
 - a. Files shall be accessible and neatly organized.
 - b. Provide a table of contents which utilizes bookmarks and links. The links shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A link shall be provided for materials associated with each piece of equipment included in the O&M manual.
 - c. Product literature which demonstrates compliance with the specifications shall be highlighted or otherwise identified to be easily found.
 - 3. Provide separate files for each submittal for each section. Combination submittals will be returned to the Contractor without review and count as 1 submittal. Do not combine submittals from multiple sections.
 - 4. Include project name, name of Engineer, contractor, sub-contractor, manufacturer, supplier, and sales representative, include name, address, and phone number for the sales representative. Clearly identify section number and description of equipment submitted. Shop drawings not including all this information will be returned without review, and count as 1 submittal.
 - 5. Examine all shop drawings noting capacity, arrangement, and physical dimensions. Clearly mark all relevant items on catalog data and cross-out unrelated information.
 - 6. Submittals for equipment provided by the Electrical Contractor shall bear a stamp or specific written certification from the Electrical Contractor, certifying the submittals have been reviewed and approved by the submitting Electrical Contractor.
 - 7. Provide the following manufacturer documentation:
 - a. Product Data Sheets:
 - 1) Product and component documentation that describe all equipment and devices proposed to be provided.
 - 2) Include all features specified.
 - 3) Provide dimensioned prints with weights.
 - 4) Highlight or otherwise accentuate on each document product numbers and description of product features which demonstrate compliance with the Contract Documents.
 - 5) Features or part numbers which do not apply shall be struck through, crossed out, blacked out, or otherwise identified as not applicable.
 - 6) Documentation which does not have such marking, and edits may be rejected and counted as one instance of Contract failure to meet submittal requirements and resubmit.
 - b. Composite Drawing:
 - 1) Power and control wiring diagrams for all systems and equipment. Control equipment to be provided with ladder type schematic diagrams.
 - 2) Show basic systems on composite drawing.
 - 3) Use terminal numbers on drawings and schematics.

- 4) Use separate drawings to show details of sub-systems.
 - 5) Identify sub-system drawing interface points on composite drawing and sub-system drawings; terminal numbers of interface points shall be the same on both drawings.
 - 6) Revise or redraw manufacturer's standard drawings to meet the above requirements.
 - 7) Documentation which does not have such marking, and edits may be rejected and counted as one instance of Contract failure to meet submittal requirements and resubmit.
 - c. Record all Changes to Existing Systems:
 - 1) Revise all wiring diagrams and schematic diagrams to show final installation:
 - a) Includes all new and existing equipment diagrams.
 - d. Programmable Systems:
 - 1) Description of programmable system operation, including but not limited to input/output functions, control capabilities, configuration procedures, starting setpoints, etc.
 - 2) Preliminary graphic screens and reports.
 - a) This submittal shall occur prior to shipment of the system.
 - e. Manufacturers Installation Instructions:
 - 1) Include with shipment.
- E. Operating and Maintenance Manuals:
1. Include all the information provided with the approved shop drawings and manufacturer's information.
 - a. Update and complete control system drawings and descriptions for all equipment.
 - b. All documentation shall include modifications made which reflect the final installation.
 - c. Provide complete testing reports.
 2. Date the manuals with the day, month, and year they are provided to the Owner/Engineer.
 3. Provide manufacturers' user manuals and installation instructions.
 4. Provide 2 digital copies in a PDF format saved to a USB drive. The saved files shall be clearly identified and organized in a similar manner to the hard copies.
 - a. Digital files to be accessible and neatly organized.
 - b. Provide a table of contents which utilizes bookmarks and links. The links shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A link shall be provided for materials associated with each piece of equipment included in the O&M manual.
 5. Record all Changes to Existing Systems
 6. Insert revised documents into the Owner's existing operation and maintenance manuals in place of original documents, if such O&Ms exist.
- F. Record Documents:
1. Provide two digital pdf copies.
 2. To be provided with the O&M's.
 3. Record drawings shall include all work scope changes, including addenda.
 4. Record drawings shall show locations of all above ceiling control devices, such as relays, contacts, control modules, monitor modules, power packs, fire/smoke detection equipment, etc.
 5. Refer to Contract Documents for additional Record Drawing requirements.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. All electrical and control equipment and materials shall be provided as specified in the Contract Documents.
- B. Where applicable, equipment and materials shall conform to ANSI, ICEA, IEEE, and NEMA Standards.
- C. All equipment and materials shall be new and shall bear the Underwriters Laboratories (UL) label if UL labels such product types. If UL does not label the product type, UL listed will be then required and documentation of such listing shall be provided. If UL does not label or list the product the type, other third-party testing agency certification which is recognized and accepted by the most recent published version of the national electrical code (NFPA 70) will be allowed.

2.2 TAMPERPROOF HARDWARE

- A. Where tamperproof hardware is required, provide torx head with center pin reject hardware for the following electrical work:
 - 1. Light fixture housings
 - 2. Covers to electrical enclosures, pull boxes, cabinets, junction boxes, wireways.
 - 3. Cover plates (both maximum security and stainless-steel cover plates)

PART 3 EXECUTION

3.1 CONSTRUCTION LIGHTING & POWER SYSTEM - REMODELING

- A. Provide construction power and lighting that adheres to the NEC Article 590 – “Temporary Installations.”
- B. Refer to Division 1 for temporary electrical services.
- C. For remodeling work in the existing building, use existing building distribution systems for construction power.
- D. Replace all receptacles, switched, cover plates, etc., damaged by any Contractor during construction.
- E. Materials furnished for the temporary light and power system remain Contractor’s property. Remove when there is no longer any need for temporary light and power or when directed by the Project Representative.
- F. The Owner shall pay electrical energy costs.

3.2 PREPARATION

- A. Continuity of Service:
 - 1. No Division 26 systems are to remain inactive at the end of the workday. Assure that the systems are all operational at the end of each workday. Coordinate temporary outages with the Owner.
 - 2. Coordinate/schedule all work with the Owner to minimize any disruptions. Confine all interruptions to the smallest possible area. Provide temporary connections if required to provide continuity of service.
 - 3. Inspect all areas affected by the interruptions and return all automatically controlled equipment, electrically operated equipment to the same operating condition prior to the interruption.
- B. Use of Facility:

1. Do not disturb normal use of the facility, except within the immediate construction area. Keep walks, driveways, entrances, etc. free and clear of equipment, material, and debris.
2. Store all equipment and material in a place and manner that minimizes congestion and is approved by the Owner.

3.3 INSTALLATION

A. Material and Workmanship

1. Provide new material and equipment, unless noted otherwise. Protect equipment and material from damage, dirt, and the weather.
2. Provide the highest quality workmanship and perform all work only by skilled mechanics. Install material and equipment in accordance with manufacturers' recommendations, instructions and current NECA standards.
3. The Engineer reserves the right to reject material or workmanship not in accordance with the specifications, before or after installation.
4. Engineer and Owner have the right to determine if equipment, boxes and covers are not accessible. Where electrical work is determined to be not accessible, Contractor shall modify the work as directed at no additional cost to the Owner.

B. Cutting and Patching:

1. Perform all cutting and patching necessary to work, unless specifically delegated to be performed under a different Division.
2. Obtain special permission from the Engineer before cutting structural members or finished material.
3. Perform all patching in a manner as to leave no visible trace and return the affected area back to the condition undisturbed before work began. All patch work to be performed by workers experienced, skilled, and licensed for the work involved. Work deemed unacceptable by the project Owner Representative will not be accepted.
4. Patch all holes left because of demolition of electrical equipment and devices.
5. Drill all holes in masonry with rotary drill. Impact tools are not allowed. Core drill all holes in masonry and concrete for electrical raceway. Provide and dispose of all water required for core drilling. Coordinate with other trades to prevent damage from water.
6. Prevent the spread of dust, debris, and other material into adjacent areas.
7. Replace all ceiling tiles damaged during installation work with new tile.

C. Painting:

1. Refinish all electrical equipment damaged during shipping and/or installation to its original condition. Remove all rust; prime, and paint per manufacturer's recommendations for finish equal to original.

D. Coordination:

1. Coordinate the location of all outlets and the associated equipment with all facility systems before installation.
2. Coordinate all door swings in the field before locating devices.
3. The contractor shall be responsible for obtaining the exact dimensions, locations, electrical ratings, and termination requirements of equipment furnished by others, from the entity furnishing or supplying the equipment.
4. If the conduit, wiring, or other equipment cannot be installed per the contract documents, including but not limited to installing concealed or in a designed space, Contractor shall notify the project Engineer or Owner Representative prior to submitting on proposed equipment and prior to starting installation of such equipment.
5. Coordinate all equipment dimensions before submitting equipment. This includes all shop fabricated work as well as work fabricated in place. It shall be assumed that equipment

submitted have been coordinated by the Contractor and the act of submitting the documents indicates Contractor and all trades have verified equipment will fit in allocated location space.

6. If the Contractor believes there is, or finds a workspace issue, Contractor shall notify project Engineer or Owner Representative prior to submitting on such equipment. Replacement or modification of equipment and/or modifications in the surrounding space it is to be installed, shall be completed by the Contractor at no additional cost to the Owner due to lack of the contractor coordination and the contractor failure to spend the energy and resources to verify the existing conditions.

3.4 FIRESTOPPING

- A. Provide firestopping around all new penetrations, sleeves and openings through all partitions, walls, and floors.
- B. Install firestopping on both sides of each partition, completely filling the void around the opening.
- C. The firestopping of interior of conduits and sleeves is by the contractor providing the cabling inside the conduit or sleeve.

3.5 ELECTRIC FIRE AND SMOKE DAMPERS

- A. Division 26 Contractor shall provide power to all smoke, fire, smoke/fire dampers which are rated 120V AC or greater.
- B. Wiring for fire alarm and other life safety monitoring and alarm shall be provided under Division 28.
- C. The contractor is responsible for coordinating the locations and requirements of the electric damper actuators with the equipment supplier and the Mechanical Contract Documents. Not all damper actuators may be indicated in the Electrical Contract Documents, refer to Division 22 and 23 and the HVAC Drawings for additional information.

3.6 RECEIVING AND STORING EQUIPMENT

- A. All equipment shall be handled and stored in accordance with the manufacturer's instructions.
- B. In general, equipment packaging is not designed to protect the contents for outdoor storage. As a minimum, Contractor shall store the equipment prior to installation in a clean, dry location free from excessive temperatures, humidity, or foreign materials normally encountered at a Site. If the storage facility is unheated, Contractor shall provide heating to protect equipment from condensation, which could cause components to corrode or to be otherwise damaged.

3.7 EQUIPMENT MOUNTING

- A. Unless noted otherwise, equipment which is not free-standing shall not be mounted on wood panels, but shall be attached to concrete or masonry walls, support channels, or building structural steel.

3.8 FIELD QUALITY CONTROL

- A. Refer to Contract Documents for additional requirements.
- B. Final Observation:
 1. A final inspection of the electrical systems will be required before the Contract can be closed out. Request a final inspection by the Engineer after all systems are fully completed and operational. The Engineer will schedule an observation and generate a list of items to

be corrected or completed before Contract Closeout. If the Contractor notifies the Engineer the work is ready for final observation, final evaluation of control systems, or commissioning exercise by the Contractor, and the Engineer finds the work is not complete enough to perform that observation, the Contractor will compensate the Engineer time used. The Contractor will then perform the necessary work to complete the project and again request a Final Observation.

3.9 CLEAN UP

- A. Keep the premises free from accumulation of waste material or rubbish, caused by his employees or work, always. Remove rubbish, tools, scaffolding, and surplus materials from and about the building, and leave work areas "broom clean" or its equivalent upon completion of the work. Clean electrical equipment and remove temporary identification. In case of dispute the Owner will remove the rubbish and charge the cost to the Contractor.
- B. After tests have been made and are accepted, the Contractor shall clean light fixtures, panels and other equipment installed by the Contractor, leaving the entire work area in a clean and complete working order.

3.10 PROTECTION

- A. Cover openings and equipment, where set, to prevent obstruction to raceways and boxes, breakage, misuse, or disfigurement of equipment. Cover openings in equipment immediately upon uncrating or receipt at the job site and keep covered until permanent connection is made.
- B. The contractor is responsible for any damage to electrical equipment or materials until final acceptance of the entire project by the Owner. Keep all equipment clean materials until final acceptance of the entire project by the Owner.
- C. If a portion of the project is to be occupied by the Owner prior to Substantial Completion of the entire project, Owner Representative will schedule with the contractor and have final decision when to transfer responsibilities for protection and housekeeping.

END OF SECTION

SECTION 26 05 10

SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes all labor, material, equipment, and services necessary and incidental to complete all the selective and or complete demolition and removal of electrical systems in the areas of remodeling or affected by remodeling, and the rework and extension of electrical systems indirectly affected by electrical system served "downstream" from the demolished electrical systems.

1.2 REFERENCES

- A. Sections 26 05 00 and all references contained therein form a part of this Section of the Specifications.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Demolition Drawings are diagrammatic and based on casual field observation and existing record documents. Report discrepancies to Owner Representative before disturbing existing installation.
- B. Examine the building to determine the actual conditions and extent of work prior to bidding on the project. Refer any unclear details or conflicts to the Owner Representative for clarification prior to bidding the drawings.
- C. Refer to all documents for additional demolition requirements which may be required to include in the bid.
- D. Verify that field measurements and circuiting arrangements are as shown on Drawings.
- E. Verify that abandoned wiring and equipment serve only abandoned facilities.
- F. Beginning of demolition means contractor accepts existing conditions.

3.2 PREPARATION

- A. Coordinate phasing of the demolition work with the construction sequence schedule.
- B. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- C. Coordinate utility service outages with Utility Company.
- D. Identify and provide new supporting means for existing electrical equipment such as low voltage cabling, conduits, boxes, pull boxes, conduit bodies, and conduit racks that will need additional support due to the demolition of the existing supports. This includes existing systems which are identified to require support and become exposed when ceilings are removed.

- E. Contractor shall provide new supports for all existing electrical conduit, cabling, fixtures, and devices which is not supported per the requirements of the NEC and becomes uncovered due to removal of ceilings or walls.
- F. Erect, and maintain temporary safeguards, including warning signs and lights and barricades for protection of the public, Owner, Contractor's employees, and existing improvements to remain.
- G. Provide temporary emergency lighting and illuminated exit signage as required by the Building Official or AHJ.
- H. Electrical Service:
 - 1. Maintain existing system throughout construction in service until new system is complete and ready for service.
 - 2. Disable system only to make switchovers and connections. Notify and obtain permission from Owner Representative at least 24 hours before partially or disabling system. Minimize outage duration.
 - 3. Make temporary connections to maintain service in areas adjacent to work area.
- I. Contractor to coordinate and sequence demolition to avoid shutdown of operation of surrounding areas.
- J. Conduct demolition to minimize interference with adjacent and occupied building areas.
- K. Perform noisy work before or after the Owner's working hours to minimum disruption.
- L. Contractor assumes responsibility if damage occurs to all devices to be reinstalled. If Contractor finds a damaged piece of equipment prior to demolition, Contractor shall note the equipment and notify the Owner's Representative and Engineer prior to removing the items. If Contractor does not provide the proper notification, Contractor will be held responsible for repairing or replacing the damaged equipment.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Owner reserves the right of first refusal to obtain material shown to be removed under this contract. Items not retained by the Owner become the property of the Contractor and must be removed from the premises and disposed at no additional costs to the Owner.
- B. Demolish electrical systems in walls, floors, and ceilings identified to be demolished.
- C. Demolish and extend existing electrical work under and this Section or as indicated on the Drawings. Remove devices, conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- D. Demolish and remove all electrical systems indicated for demolition. No portion of these systems may be abandoned in place.
- E. Remove, relocate, and extend existing installations to accommodate new construction or to maintain systems downstream from demolished area.
- F. Provide support for all existing electrical equipment that was supported previously by demolished walls, floors, ceiling, or other structures. Provide new supports from structural members not slated for demolition, prior to any demolition.
- G. Remove abandoned wiring to source of supply.
- H. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit in walls, floors, or columns back to a point where patching can be adequately performed and patch surfaces.

- I. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if raceway serving them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- J. Disconnect and remove abandoned panelboards and distribution equipment.
- K. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- L. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
- M. Repair adjacent construction and finishes damaged during demolition and extension work.
- N. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- O. Relocate and reroute conduit and wiring to remain which is concealed in walls or structure being altered as part of the part. Maintain continuity to all devices in and downstream of project area. Existing installations to be extended using materials and methods compatible with existing electrical installations, or as specified.
- P. Reroute existing raceway and wiring which. is exposed due to removal of existing construction. Conceal new raceway and wiring and maintain operation.
- Q. If conductors are required to be removed from existing raceways, install with new conductors.
- R. Provide new device cover plates throughout the remodeled areas.
- S. Seal all holes and openings left in smoke, sound or fire rated walls, ceilings, or floors. Completely fill with intumescent type fire rated barrier.
- T. When ceilings are to be removed and ceiling devices such as luminaires, receptacles, WAP's, fire alarm equipment, security equipment, and others is indicated to be removed and reinstalled, Contractor shall remove and store the equipment offsite until the project has advanced enough and the equipment can be reinstalled. The Contractor may elect to temporarily support the devices in place; however, Contractor must coordinate this with all disciplines and Contractor is responsible for removing and/or relocating the equipment as needed during the project.

3.4 EXISTING PANELBOARDS

- A. Identify circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits which are available for reuse. Reuse breakers if possible. Provide new breakers for new equipment unless breakers are specifically noted on the plans to be reused.
- B. Tag unused circuits as spare and turn breakers and/or switches off.
- C. When existing circuits are indicated to be reused use verify these circuits are not already in use by other circuits.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Where existing panelboards are indicated to be demolished, extend any remaining live circuits to the nearest suitable panelboard.
- F. Clean out debris, dust and dirt from existing panelboards which are modified under this project.

- G. Provide updated panelboard schedules at the end of every work shift. Temporary panel schedules may be handwritten and posted on or near the panelboard.
- H. Provide new updated machine typed directories for every panelboard modified under this project prior to substantial completion. Directories to be provided in a clear protective sleeve attached to inner side of panel door.

3.5 CLEANING AND REPAIR

- A. Prior to reinstallation of used equipment, thoroughly inspect each item and report any defects to the Owner Representative in writing. Instructions for corrective measures will be given at the time and the Contract amount adjusted accordingly. If no defects are reported, the material will be included under the project warranty.
- B. Equipment: Clean exposed surfaces and interior. Check tightness of electrical connections.
- C. Luminaries:
 - 1. Where existing luminaries are indicated to be re-used, remove existing luminaries for cleaning. Use mild detergent to clean all exterior and interior surfaces, rinse with clean water and wipe dry.
 - 2. Replace parts which become damaged due to work during the construction period.
 - 3. Provide new lamps, if such fixtures utilizes lamps.
- D. Repair adjacent construction and finishes damaged during demolition and extension work.

3.6 INSTALLATION

- A. Install relocated materials and equipment as indicated on the drawings.

END OF SECTION

SECTION 26 05 19

CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes, but not limited to:
 - 1. Wire
 - 2. Metal Clad (MC) Cable
 - 3. Retractable (Coiling) Cords
 - 4. Retractable Corded Reels
 - 5. Variable Frequency Drive Cable.
 - 6. Multi-conductor Instrument Cable.
 - 7. Vehicle Detection Loop.
 - 8. Direct Burial Cable.
 - 9. Data Cabling.
 - 10. Optical Fiber Cable.
 - 11. Specialty Cable.
 - 12. Terminals and connectors.
 - 13. Installation.
 - 14. Splices, Taps, and Terminations.
 - 15. Identification.

1.2 REFERENCES

- A. Section 26 05 00: Common Work Results for Electrical
- B. Section 26 08 00: Testing and Adjustments to Electrical Systems

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 26 05 00.

PART 2 PRODUCTS

2.1 WIRE

- A. All wire and cable shall be:
 - 1. New and coiled or on reels.
 - 2. Each coil and/or reel shall have a label with the manufacturer's name, trade name of wire, size of wire, and UL label.
- B. Provide conductors with a 90°C insulation system, 600-volt rating, U.L. approved and listed for specific application.
- C. Feeder and Branch Circuit Wire:
 - 1. Stranded conductor, unless noted otherwise.
 - a. Solid copper conductors are to be used for lighting and convenience receptacle circuits.
 - 2. THWN insulated for conductor sizes #4 AWG and smaller.
 - 3. XHHW or THWN insulation for conductor sizes #3 AWG and larger.
- D. Provide minimum No. 12 AWG conductor size, unless noted otherwise.
 - 1. Where noted conductors used for control to/from field devices may be less than 12AWG in size providing the following requirements are met:

- a. Unless otherwise specified elsewhere in these specifications, control wiring shall be not less than No. 14 AWG.
 - b. Control wiring shall be sized such that the voltage drop under in-rush and continuous operation conditions does not adversely affect operation of the controls.
- E. Conductors may be copper or aluminum, within the constraints of the specifications.

2.2 METAL CLAD (MC) CABLE

- A. Provide MC cable only where specifically allowed.
- B. Provide UL Listed cable, rated for 600 volts and 90°C.
- C. Provide factory assembly of one or more conductors enclosed in a metallic sheath that consists of a continuous flexible corrugated aluminum interlocked armor.
- D. Separate equipment grounding conductor.
- E. Each conductor shall be separately insulated in the cable, including ground wire(s).

2.3 MULTI-CONDUCTOR INSTRUMENT CABLE

- A. 2-conductor, 3-conductor, or 4-conductor as required by the process or equipment.
- B. Twisted shielded cable, Aluminum foil shield and drain wire.
- C. Stranded tinned copper conductors, minimum size of #16 AWG copper.
- D. Polyethylene color-coded insulation.
- E. Overall PVC or neoprene jacket which is resistant to oil, ozone, moisture, and sunlight.
- F. Contractor shall verify cable and signal requirement with equipment manufacturer recommendations. Special instrument and signal cable shall be provided with the equipment which requires them.

2.4 VOICE AND DATA CABLING

- A. Provide voice and data cabling with the following minimum specifications:
 - 1. Plenum rated cable.
 - 2. ANSI/EIA/TIA-568-B.2 Category 6 compliant.
 - 3. 22AWG size conductors.
- B. Provide equipment, testing, and certification by the manufacturers of the equipment as an installed system that meets Category 6 standards for structured voice, data and video cabling systems, including the terminations and outlet devices.
- C. Cable and Device Jack Colors:
 - 1. Blue - General Building premise LAN Cabling and LAN Jacks
 - 2. Violet/Purple - All Isolated HVAC / Facility Network Building Cabling, LAN Jacks and related patch cables. This HVAC / Facility / Energy Management Network is completely isolated from the normal District wide instructional network.
- D. Patch Panel Cables and End Point Patch Cable Color:
 - 1. White - VoIP Telephones and other Telephone IP Equipment.
 - 2. Gray - WiFi Access Points and other Wireless Network IP Equipment.
 - 3. Pink - Older GE Secure/Facility Commander Keyless Entry patch and node cables.
 - 4. Green - Access Control (Keycard) systems.
 - 5. Black - Data Switch/Router Equipment Uplinks.
 - 6. Green - Security/Intrusion Detection (DMP&DSC panels) AND Time Clocks (TrueTime).

7. Yellow - CCTV Surveillance Cameras & DVR/NVR devices.
 8. Orange - AV Devices... TV, Apple TV, Airtame and other Audio-Visual devices, Intercom and Paging.
 9. Blue - General computer, printer devices and other devices not listed above.
- E. Approved manufacturers:
1. Hitachi
 2. Superior-Essex
 3. CommScope/Uniprise
 4. General Cable
 5. Or equal

2.5 WIRE COLOR CODING

- A. Contractor may use color coding at his discretion, except for the following colors, which shall be used only as designated below for both power and control circuits.

1. Control Circuits
 - a. Dark Blue - Direct current circuits.
 - b. Light Blue - Intrinsically safe conductors.
 - c. Green - Grounding conductor.
 - d. White - Neutral conductor.

2. Power Circuits

	120/240V	208Y/120V	480Y/277V
Phase A	Black	Black	Brown
Phase B	Red	Red	Orange
Phase C		Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green

3. Use solid colors through Size No. 8 AWG.
4. Use black conductors with tape color identification No. 6 AWG and larger.

2.6 TERMINALS AND CONNECTORS

- A. Tool compressed terminals and connectors shall be made of 1 piece seamless highly conductive copper with a uniform tin-plate coating to minimize corrosion.
- B. Step-down adapters shall be copper compression type.
- C. Electrical spring connectors:
1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for application used.
 2. The integral insulator shall have a skirt to completely cover the stripped conductors.
- D. Electrical push-in connectors:
1. Nylon/PC housing material.
 2. Copper contacts with tin plating.
 3. Rated for 221-degree F.
 4. 2,3 or 4 port as needed per circuit. Do not provide unused ports.
 5. Sized per wire gauge.
 6. To be used with wire gauge 12 and smaller.
 7. UL Listed.

8. Manufacturer:
 - a. Ideal
 - b. Or pre-approved equal.
- E. Fork Terminals:
 1. Vinyl or nylon self-insulated locking type.
 2. Terminal insulation that supports wire insulation.
 3. Manufacturer:
 - a. Thomas & Betts Type FL
 - b. Burndy Type TP-LF
 - c. Panduit Type PNF
 - d. 3M Type MNG.
- F. Electrical Tape:
 1. UL Listed.
 2. Weather resistant.
 3. Moisture resistant vinyl.
 4. Rated for the voltage system which it is applied.
 5. Temperature rating suitable for the application where it is applied.
- G. Motor Connection Kit:
 1. UL Listed.
 2. Qualified to ANSI standards.
 3. Rated to withstand 1000V.
 4. For use on in-line or stub motor lead splices.
 5. Resistant to abrasion.
 6. Installed per manufacturer's recommendations.
- H. Underground Splices for No. 10 AWG and Smaller:
 1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations and approved for copper and aluminum conductors.
 2. The integral insulator shall have a skirt to completely cover the stripped conductors.
 3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- I. Underground Splices for No. 8 AWG and Larger:
 1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations and approved for copper and aluminum conductors.
 2. Insulate with materials approved for the particular use, location, voltage, and temperature. The insulation level shall be not less than the insulation level of the conductors being joined.
 3. Splice and insulation shall be products of the same manufacturer.

2.7 CONDUCTOR PULLING COMPOUND

- A. Rated for use with conductor insulation and conduit material.
- B. Non-conductive.
- C. Non-cementing.
- D. Dry to a fine lubricating powder or a thin film which does not harden in conduit.
- E. UL Listed.
- F. Rated for repeated exposure to high heat or freezing temperatures.

PART 3 EXECUTION

3.1 WIRE INSTALLATION

- A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
- B. Install all conductors in a continuous raceway system.
- C. Splice conductors only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.
- D. Pulling compound shall be approved by the cable manufacturer.
- E. Conductors of different voltage systems shall not be installed in the same raceway.
- F. Examine all wires before installation. Do not use any wire with insulation that is damaged in any way.
- G. Do not pull wire into the conduit until the conduit system is complete. Pull all conductors into the raceway at the same time.
- H. Adequate measures are to be employed to determine that the raceways are free of foreign material and moisture before pulling wire or cable.
- I. Test all cable and wire for continuity and for shorts prior to energizing any circuits.
- J. Conductors shall extend at least 4" past the point of the cover on any junction or pull box installed.
- K. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- L. Conductors shall be without splice from termination to termination, unless indicated otherwise on the Drawings.
- M. Provide an equipment grounding conductor with each circuit.
- N. The use of a shared neutral on multiwire branch circuits will not be allowed. Each circuit shall be provided with its own neutral conductor(s), unless noted otherwise in the Contract Documents.
- O. The contractor shall provide conductors with the appropriate rating and quantity for each circuit.
 - 1. Voltage Drop Calculations:
 - a. Wire shall be sized for a voltage drop no greater than 2% measured for circuits used to feed panelboard, distribution panels, switchboards, and service equipment.
 - b. Wire shall be sized for a voltage drop no greater than 3% measured from the feeder panelboard or switchgear to its point of load termination.
 - c. Contractor shall provide documentation of voltage drop calculations upon request of Engineer or Owner.
 - 2. Where multiple conductors are used in a shared raceway, conductor ratings shall be derated per the NEC.
 - 3. Where conductor sizes are specified in the Contract Documents, these sizes are based on copper conductors.

3.2 ALUMINUM CONDUCTORS

- A. Where copper-clad aluminum, or aluminum alloy conductors are used in lieu of copper conductors, the conductor size must be adjusted to provide equal or greater ampacity of the conductor indicated. This adjustment shall be based on using the ampacity for the equivalent

insulation of the conductor indicated. All conductor sizes indicated on the drawings are based on copper conductors.

- B. Where copper clad Aluminum or aluminum-alloy conductors are allowed to be used, all raceways must be adjusted to accommodate increased conductor sizes.
- C. Do not substitute smaller conductors with higher temperature rated insulation.
- D. The smallest allowable size for aluminum conductors is 1/0. All other conductors shall be copper.
- E. All conductors used for grounding electrode bonding, equipotential bonding and between wall mounted grounding buses shall be copper.

3.3 SPLICES, TAPS AND TERMINATIONS

- A. Splices to feeders and service entrance conductors are not permitted unless specifically noted on the plans.
- B. Electrical spring connectors shall be used for splices and taps in lighting and 120-volt receptacle circuits and motor leads #10AWG or smaller.
- C. Use pressure or compression type connectors for all splices or taps in copper conductors.
- D. Do not splice conductors of dissimilar metals together.
- E. Use only compression type connectors for all splices, taps, and terminations using copper-clad aluminum or aluminum alloy conductors.

3.4 METAL CLAD (MC) CABLE INSTALLATION

- A. MC cable will only be allowed in the applications specifically as follows in this paragraph:
 - 1. Individual cable drops from a junction box to light fixtures.
 - a. Direct fixture to fixture connections is not allowed.
 - b. The maximum length of cable is a 6' connection to a light fixture.
 - 2. Individual cable drops to ceiling mounted equipment, such as receptacles or ceiling fans.
 - a. The maximum length of cable is a 4'.
 - 3. Wiring in metal or wood stud walls, such as ceiling drops to receptacles. Wiring not concealed in walls to be installed in conduit. MC cable shall run to junction box near the point the MC cable stubs out from the wall near the structural ceiling.
- B. Where MC cable is allowed to be used as specified above, the following restriction on MC cable use shall be observed. These restrictions are in addition to the requirements found in the NEC:
 - 1. The home runs to panel shall consist of approved conduit and wire. (Unless otherwise noted).
 - 2. Do not install MC cable in blocks, brick walls, and in or under concrete slabs.
 - 3. Do not install MC cable within or supported from a communications cable tray/ladder.
 - 4. Do not use MC cable in areas where cable would be exposed.
 - 5. Provide MC cable only above lay-in grid ceilings.
 - 6. Route MC cable parallel and perpendicular to building structure.
 - 7. All other wiring and cabling for systems shall be provided in a conduit system, unless noted otherwise in the Contract Documents.

3.5 VOICE AND DATA CABLING INSTALLATION

- A. Provide cabling from each voice and data location to the technology headend equipment.
- B. Number of cables:

1. Provide a dedicated cable for each port identified.
 2. When a voice/data outlet is shown without a port quantity, provide two cables: one for voice and one for data, unless noted otherwise.
 3. When a data or phone outlet is shown and quantity of ports is not identified, provide 1 cable, unless noted otherwise.
- C. Cabling shall be installed from the wall outlet to the head end location without splice.
- D. Install connector on each end of cable.
- E. Identify each cable to which outlet, port, and room it is from. Label shall be 2-3' from end of cable end.
- F. Every cable shall be provided with a RJ485 keystone jack on each end using 568A standard.
- G. Cabling for CCTV and Vape detector shall be supplied with 20' of extra cable on both ends.
- H. Cable Testing:
1. Coordinate with ISD 742 Media Services. Prepare final test plan to the School District in both one paper copy and one digital copy saved as PDF. After installation and testing has been completed, submit test report to include:
 - a. Cable run termination point descriptions to easily identify locations
 - b. Cable length
 - c. Wire mapping
 - d. Near end crosstalk (NEXT)
 - e. Insertion loss
 - f. Cable return loss
 - g. Propagation delay
 - h. Delay skew
 - i. Test equipment nomenclature, model, serial number, and manufacturer
 - j. Calibrated dates and calibration expiration date, copy of calibration certification.
 - k. Testing performed by Name, Organization, telephone numbers.
- I. Label all outlets and termination ends of cables using ISD 742 standards for labeling. The following shall be referenced in each label. Coordinate all labeling requirements with Owner prior to installing cable and devices.
1. Description of device termination point
 2. Closet #
 3. Patch Panel #
 4. Port #

3.6 IDENTIFICATION

- A. Control circuits may be color-coded using available colors, except gray and green. They shall be identified at each terminal at the respective control panel with a label. Imprinted labels shall be protected by a heat shrinkable sleeve.
- B. Each control circuit shall be identified at both ends with the same number; the wire number shall be the same as the wire number shown on the Contractor's Equipment Drawings. Spare conductors shall also be identified.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding Electrode System
- B. Equipment grounding
- C. Transformer grounding.
- D. Grounding of technology, security, and data rooms.
- E. Bonding of new building additions
- F. Bonding of Pool Equipment
- G. Patient Room Grounding and Bonding
- H. Swimming Pools, Fountains, and Similar Installations.

PART 2 EQUIPMENT

2.1 GROUNDING CONNECTORS

- A. Clamps and pressure connectors.
 - 1. Clamps for connection to piping and conduit:
 - a. Approved Manufacturer:
 - 1) OZ Gedney type ABG
 - 2) Burndy "Hyground"
 - 3) Thomas & Betts "Blackburn" Series.
 - 2. Clamps for connection to enclosures and bus work:
 - a. Approved Manufacturer:
 - 1) OZ Gedney type KGM
 - 2) Burndy "Hyground"
 - 3) Thomas & Betts "Blackburn" Series.
 - 3. Bar taps for connection to bus bars which are UL listed (UL-467).
 - a. Approved Manufacturer:
 - 1) OZ Gedney type KGM
 - 2) Burndy "Hyground"
 - 3) Thomas & Betts "Blackburn" Series.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Raceways provided for grounding electrode conductors shall be rigid nonmetallic.
- B. The conductor shall be connected to the equipment ground bus or to the enclosure if there is no ground bus.
- C. Separately derived systems shall be grounded in accordance with NFPA 70.
- D. The grounding bushings on conduits entering distribution equipment shall be connected to the ground bus in accordance with the requirements of NFPA 70.

- E. All conductors used for grounding electrode bonding, equipotential bonding and between wall mounted grounding buses shall be copper.

3.2 EQUIPMENT GROUND

- A. Solidly ground all conduit systems, switch boxes, cabinets, motor frames, switchgear, transformers, and all other permanently installed equipment to form a continuous, permanent, and effective grounding system. Bond expansion joints and metal raceway sections.
- B. An equipment grounding conductor shall be installed with each conduit run or cable, including but not limited to feeder circuits, motor circuits, lighting circuits, and control circuits.

3.3 BONDING

- A. Bond all systems per the NEC including raceway, cable tray, enclosures, metal piping systems, structural metal, and other items identified in the Contract Documents or the National Electrical Code.

3.4 SPECIAL REQUIREMENTS

- A. The contractor shall determine if there are any other special grounding requirements for equipment furnished on this Project and shall provide grounding as recommended by the manufacturer.

END OF SECTION

SECTION 26 05 29
SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Manufactured Supporting Devices.
- B. Fabricated Supporting Devices.
- C. Installation.

1.2 DESCRIPTION OF WORK

- A. Type of support hardware, anchors, sleeves, and seals specified in this section include the following:
 - 1. Clevis hangers
 - 2. Riser clamps
 - 3. C-clamps
 - 4. I-beam clamps
 - 5. One-hole conduit straps
 - 6. Two-hole conduit straps
 - 7. Round steel rods
 - 8. Expansion anchors
 - 9. Toggle bolts
 - 10. Wall and floor seals
- B. Supports, anchors and sleeves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 26 sections.

1.3 QUALITY ASSURANCE

- A. Provide supporting devices, of types, sizes, and ratings required that are manufactured by firms regularly engaged in the manufacture of such devices.
- B. Comply with NEC as applicable to construction and installation of electrical supporting devices.
- C. Comply with applicable requirements of ANSI/NEMA std Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies".
- D. Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- E. Provide electrical components which are UL-listed and labeled.

PART 2 PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

- A. Provide supporting devices; complying with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for a complete installation; and as herein specified. Where more than one type of device meets indicated requirements, selection is Installers' option.
- B. Provide support and anchors constructed of stainless steel, PVC, or equivalent corrosion resistant material in chemical storage rooms.

- C. Structural flat surfaces:
1. Caddy snap close clamp with z shot-fire bracket; mechanical fastener appropriate for deck type; spring steel, snap close conduit opening, static load of 100lbs or greater may be used with conduit sizes equal to and between 0.5" and 1".
 2. Caddy bolt close clamp with z shot-fire bracket; mechanical fastener appropriate for deck type; spring steel, conduit strap with threaded openings and hex-head bolt, static load of 100lbs or greater may be used with conduit sizes equal to and between 0.5" and 1".
 3. One-hole conduit straps for supporting metal conduit; galvanized steel may be used with conduit sizes equal to and between 0.5" and 0.75".
 4. Two-hole conduit straps for supporting metal conduit; galvanized steel to be used with conduit sizes equal to and larger than 1".
- D. Beam flange:
1. Caddy clip for supporting conduit to beam flanges; spring steel, snap close conduit opening, static load of 75lbs or greater may be used with conduit sizes equal to and between 0.5" and 0.75".
 2. Beam Clamp; steel; mechanical bolt fastener to beam; conduit strap with threaded holes and hex-head bolt may be used with conduit sizes equal to and between 0.5" and 1.5".
 3. Right angle conduit clamp: cast iron hot dipped galvanized; U-bolt with treaded ends and hex-head nuts may be used with conduit sizes equal to and between 2" and 4".
 4. One-hole conduit straps for supporting metal conduit; galvanized steel may be used with conduit sizes equal to and between 0.5" and 0.75".
 5. Two-hole conduit straps for supporting metal conduit; galvanized steel to be used with conduit sizes equal to and larger than 1".
- E. Rod Type Hangers:
1. Clevis type hangers; with diameter hole for round steel rod.
 2. Hexagon nuts on both ends of rod:
 - a. Conduit size 0.5"-1.5": Minimum rod size 3/8".
 - b. Conduit size 2" to 3.5": Minimum rod size 1/2".
 - c. Conduit size 4"-5": Minimum rod size 5/8".
 3. C-clamps for supporting rods to beam flanges; mechanical bolt fastener.
 4. Galvanized steel for dry location inside buildings. Corrosion resistant material when used in corrosive spaces and outdoors.
- F. Provide anchors of types and sizes indicated:
1. Expansion Anchors: 1/2"
 2. Toggle Bolts: Springhead; 3/16" x 4"
- G. Provide channel strut system for supporting electrical equipment, 16-gage hot dip galvanized steel, or types and sizes indicated; construct with 9/16" dia. holes, 8"o.c. on top surface, with standard green finish, and with the following fittings which mate and match with channel provided:
1. Fixture hangers
 2. Channel hangers
 3. End caps
 4. Beam Clamps
 5. Wiring stud
 6. Thin wall conduit clamps
 7. Rigid conduit clamps
 8. Conduit hangers
 9. U-bolts

2.2 FABRICATED SUPPORTING DEVICES:

- A. Provide sleeves of one of the following:
 - 1. Sheet-metal fabricated from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage. Sheet metal sleeves shall not be used for cable.
 - 2. Steel-Pipe fabricated from Schedule 40 galvanized steel pipe; remove burrs.
 - 3. Iron-Pipe fabricated from cast-iron or ductile-iron pipe; remove burrs.

2.3 SLEAVES, SEALS AND CAULK

- A. Sleeves:
 - 1. Conduit sleeves to be 1.5" larger than O.D. of conduit.
 - 2. Set all sleeves true to line, grade, and position and plumb or level after concrete is poured. Correct any deviation from proper position.
 - 3. Sleeves to be anchored to structure.
- B. Seals:
 - 1. Provide factory-assembled wall and floor seals. Provide watertight seals around conduit, pipe, or tubing passing through concrete below grad floors and wall. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
 - 2. Subject to compliance with requirements, provide water-tight seals by:
 - a. Thunderline
 - b. Pre-approved equal.
- C. Fire sealant and caulk
 - 1. Caulk spaces between pipe and floor sleeves inside the building with a waterproof caulking material. Caulk spaces between pipe and exterior partition sleeves with glass fiber insulation.
 - 2. Furnish sealable penetration pockets compatible with the building roofing system where conduits pass through the roof. Turn pockets over to the Owner Representative.
 - 3. Provide fire barrier sleeve seals for sleeves located in floor and firewalls. Provide approved fire barrier material.
 - 4. Provide minimum of 4-hour fire barriers around conduit, pipe, tubing, bus ducts and cables passing through smoke and fire rated floors and walls. Fire sealant to be red when cured.
 - 5. Subject to compliance with requirements, and if not specified elsewhere fire sealant to be:
 - a. 3M CP25WP+
 - b. 3M 3000WT
 - c. Dow Corning Firestop 700
 - d. General Electric

PART 3 EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

- A. Install hanger, anchors and sleeves in accordance with manufacturers' written instructions and with recognized industry practices to ensure supporting devices comply with requirements of NECA, NEC and ANSI/NEMA. Extend sleeves 3/4" above floor surface.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

- C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Support suspended conduit runs threaded rod and galvanized conduit hangers. Attach the hanger rod to concrete structural members with malleable iron inserts, to existing or precast concrete structural members with self-drilling anchors, to structural steel with steel "C" clamps, and to wood with suitable sized lag screws and angles. Support multiple parallel conduits runs on trapeze hangers constructed of steel rod hangers and structural channel. Include three (3) nuts jam-locked, on all threaded rod hangers, to rigidly support the conduit. Install supports with maximum spacings indicated.
- D. Support surface mounted conduit runs with galvanized pipe straps. Fasten pipe straps to masonry surfaces with self-drilling anchors or toggle bolts. Fasten pipe straps to wood or sheet metal surfaces with pan head sheet metal screws.
- E. Support wall mounted electrical equipment on 3/4" thick C-D exterior fir plywood painted with two (2) coats of ASA-49 gray enamel.
- F. Provide stainless steel screws where electrical equipment is mounted on or attached to fire treated plywood. Hold equipment away from the plywood with either plastic or stainless-steel washers or spacers.
- G. Support all ceiling mounted receptacles with a listed tile bridge spanning the suspended ceiling grid, plus a 1/4" threaded rod anchored to a structurally sound member directly above the outlet box.
- H. Tighten sleeve seal nuts until sealing grommet have expanded to form water-tight seal.
- I. Provide finish of supporting devices in the chemical storage room as follows:
 - 1. Provide PVC-coated galvanized concrete inserts and pipe straps.
 - 2. Provide stainless steel for all bolts, nuts, washers, and screws.
 - 3. Provide PVC-coated individual hangers and trapeze hangers.
 - 4. Provide individual galvanized rods with two (2) coats of epoxy paints.

3.2 LIGHT FIXTURE SUPPORTS

- A. Securely support all light fixtures directly from building structural members or 1-1/2" or larger steel ceiling framing channels. Use steel channel where it is necessary to span the building structural members for equipment support.
 - 1. Wood supporting members or wires will not be acceptable.
 - 2. Provide minimum 1/4" diameter lag screws when anchoring into wood structural members. Penetrate wood structural members a minimum of 2" with all screws.
 - 3. Provide steel expandable type, anchors with minimum penetration of 1-1/2" when anchoring to concrete.
 - 4. Do not suspend any conduit, light fixtures, or ballasts from metal roof deck or from the ceiling suspension wires. Support all lay-in fixtures independent of the ceiling support system.
 - a. In lay-in ceilings provide fastening clips on each corner of each fixture.
 - b. Where fixture suspension wires are required, wires shall be fastened to a structural member directly above or no greater than a 5-degree angle from the light fixture corner of which it is fastened to.
 - c. Fixture suspension wires shall be provided so that fixture is not allowed to drop more than 1" if ceiling would happen to collapse.
- B. Equip all fixtures using conduit stems with ball swivel hangers. In finished areas, provide canopies for the hangers.

- C. Support all surface mounted fixtures with a minimum of one hanger per fixture plus one per row. Support individual fixtures with a minimum of two hangers. Attach fixture hangers to the ceiling grid per code.
- D. Support all suspended fixtures with a minimum of two fixture hangers. Attach each hanger to a dedicated anchor. Locate hangers directly above the corners of the light fixtures.

END OF SECTION

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SECTION 26 05 33

RACEWAYS, FITTINGS, AND BOXES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Conduit.
 - 2. Conduit fittings.
 - 3. Conduit accessories
 - 4. Underground warning tape.
 - 5. Pull and junction boxes.
 - 6. Fire stop material.
 - 7. Handholes.
 - 8. Conduit Identification.
 - 9. Execution/Installation.

1.2 REFERENCES

- A. Section 07 84 00: Firestopping.
- B. Section 26 05 00: Common Work Results for Electrical
- C. Section 26 05 26: Grounding and Bonding for Electrical Systems
- D. Section 26 05 29: Supporting Devices
- E. Section 26 27 26: Wiring Devices
- F. Section 33 05 05: Trenching and Backfilling.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 26 05 00 in addition to the requirements of this section.

PART 2 PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS.

- A. Electro-galvanized tubing conforming to UL Standard UL797, with the interior having a smooth coating of aluminum lacquer or enamel.
- B. Do not thread tubing.
- C. Provide concrete-tight steel compression or set-screw type fittings, couplings, and bushings. Cast or indentor type devices are not acceptable.

2.2 FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS.

- A. Hot-dip galvanized tubing conforming to U.L. Standard ULI.
- B. Provide steel or malleable iron type fittings, couplings, and bushings. Cast type devices are not acceptable.

2.3 COPPER METAL CLAD (MC) CABLE

- A. Refer to Section 26 05 19 – 600 Volt Conductors and Cables.

2.4 OUTLET AND JUNCTION BOXES

- A. Provide galvanized code gauge metal outlet and junction boxes with screw-on covers of type, shape and size listed for each application.
- B. Provide gasketed covers in damp and dusty locations and where required to meet the listed use (i.e. wet locations).
- C. Provide cast metal boxes (FS and FD) for all locations where IMC and RMC are required under Section 26 05 33.
- D. Provide 4" square minimum trade size square boxes for all outlet and junction boxes. Provide appropriate mud rings, tile rings or raised covers, depending on the application and allowable installation.
- E. Provide 3½" deep boxes when installed in masonry, including precast construction. Provide 2⅝" minimum deep boxes when installed in non-masonry locations. Shallower boxes (1½", 1¼") are allowed only at locations where the wall cavity depth does not permit deeper boxes to be installed concealed within the wall.
- F. Provide outlet boxes with green grounding pigtail pre-terminated to the interior of the box, to be used to ground the wiring device(s).
- G. Refer to other sections for additional outlet box requirements specific to other systems.
- H. Provide boxes with the appropriate size and quantity of conduit knock outs. Knock outs may be pulled or reamed out to larger sizes on most steel boxes.
- I. Approved steel box manufacturers:
 - 1. Raco
 - 2. Steel City
 - 3. Pre-approved equal
- J. Approved cast metal box manufacturers
 - 1. Appleton
 - 2. Crouse-Hinds
 - 3. Killark
 - 4. Bell
 - 5. Red Dot
 - 6. Pre-approved equal.

2.5 INTERIOR PULLBOXES

- A. Provide listed metal boxes with removeable screw-on covers.
- B. Boxes with a dimension larger than 12" shall have a cover attached with hinges and stainless-steel screws located within 1/2 inch of each corner opposite the hinges and spaced not more than 12 inches apart.
- C. Size boxes to adhere to the NEC.
- D. Provide enclosures that have a NEMA rating that meet or exceed the environment in which they are installed.
- E. Approved manufacturers:
 - 1. Hoffman Enclosures
 - 2. Electro Mechanical Industries (EMI)
 - 3. American Midwest Power (AMP)
 - 4. Pre-approved equal.

2.6 FLOOR BOXES

A. Poke-Through Box:

1. Poke-thru box to provide an interface between power, communication and audio/visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power, communication and/or A/V device outlets are required.
2. UL Listed for scrub water exclusion.
3. Insert:
 - a. The insert body shall recess the devices a minimum of 2-3/4 inches and have a polyester based backing enamel finished interior, ivory color. Furnish with necessary channels to provide complete separation of power and communication services.
 - b. Provide three (3) compartments that allow for up to three (3) duplex receptacles that can be wired as a standard receptacle or isolated ground and/or 12 communication ports and/or 10 A/V devices or 10 data devices.
 - c. The body consists of an intumescent firestop material to maintain fire rating of the floor slab. Hold intumescent material securely in place in insert body. Intumescent material will not have to be adjusted to maintain the fire rating of the unit and the floor slab.
 - d. Provide insert with a retaining feature to hold the poke-thru device in the floor slab without additional fasteners.
 - e. The poke-thru insert shall also consist of a 3/4-inch trade size conduit stub that is connected to the insert body and a stamped steel junction box for power wire splicing and connections. The stamped steel junction box shall also contain the means necessary to electrically ground the poke-thru device to the system ground.
 - 1) Provide a 1.25" conduit assembly for routing A/V and data cabling.
 - a) A pass-through bottom plate may be used for A/V and data cabling where cabling is not ran through conduit.
4. Activation Cover:
 - a. Manufactured of die-cast aluminum alloy; finished in powder-coated color to be determined during submittal review. Provide with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness.
 - b. Activation covers to be 9-1/4 inches in diameter.
 - c. Provide cover with spring-loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible without a cover or flap sticking up above the floor surface.
5. Device Plates:
 - a. Provide a thermoplastic device cover over each device and compartment.
 - b. Provide each box with a minimum of 1 device cover for MAAP devices.
 - c. Provide blank plates over spare compartments.
6. Approved Manufacturer:
 - a. Legrand Evolution Poke-Through Series
 - b. Pre-approved Equal.

2.7 DUCT SEALING COMPOUND

- A. Soft, fibrous, slightly tacky, non-hardening, and easily applied by hand at all working temperatures.
- B. Clean and non-staining.
- C. J.M. Clipper Corp. Duxseal, O-Z/Gedney DUX, or equal.

2.8 WIREWAYS

- A. NEMA 12, minimum 14-gauge steel, ANSI 61 gray enamel finish inside and out over phosphatized surfaces.
- B. 14-gauge stainless steel for corrosive environments.
- C. Smooth, rounded edges on all sections and fittings.
- D. Hinge type with screw clamps which are galvanized or stainless steel.
- E. UL listed (UL-870).

PART 3 EXECUTION

3.1 CONDUIT SIZES

- A. Verify conduit sizes indicated on the Contract Documents prior to installation. Provide proper size conduit based on the NEC maximum fill requirements, including any derating factors. Where conduit sizes are indicated on the plans, it is a minimum size allowed. It is the Contractor's responsibility to provide the proper conduit size, including any grounding conductors and flexible connections to equipment.
- B. Where conduit sizes are not shown, provide conduit with the minimum sizes:
 - 1. 1.25" conduit for underground.
 - 2. 3/4" conduit size for branch circuit homeruns.
 - 3. 1/2" conduit size everywhere else.
 - 4. Unless noted otherwise.
- C. Spare conduits shall be sized as noted in the Contract Documents. Where spare conduit sizes are not identified provide a minimum size of 1.25".

3.2 INSTALLATION

- A. Installation of conduit shall meet the requirements of the NEC and the National Electrical Contractors Association (NECA) conduit installation standards. Where the documents may conflict, the requirements of the NEC take precedence.
- B. Install all line voltage (120, 208, 277 and 480 volt) conductors in a continuous raceway system, or MC cabling.
- C. Install all technology low-voltage cabling conductors in a continuous raceway system when installed in and through walls and floors.
- D. Circuits of different voltage systems shall be installed in separate raceways, unless specifically noted otherwise in the Contract Documents.
- E. Provide pull and junction boxes as required by the NEC and as site pulling requirements dictate.
- F. Conduits entering boxes and equipment from a flat surface shall be provided with an offset 3" from the box to allow the conduit to be fastened securely to the flat surface it is run on.
- G. Do not route any conduits across rooftops, unless specifically allowed and noted on the plans to do so. Where conduits are allowed to be routed across rooftops, install conductors in Rigid Metal Conduit and provide proper derating of the conductor ampacities to account for the high ambient temperature as required in NEC. Mount conduit on roof blocks specifically designed for the intended environment.
- H. Support all trapezes and all above-ground conduits from the building structure.
- I. Route all horizontal raceway above water piping, where possible.

- J. Do not support conduit with wire, nylon ties, nor perforated pipe straps. Remove wire used for temporary support.
- K. Do not attach conduit to ceiling support wires.
- L. Run all exposed conduit in a neat, workmanlike manner parallel to the building lines, tight to the wall and ceiling surfaces, and firmly support with conduit clamps or hangers.
- M. Do not run conduits in the following:
 - 1. Columns except feed column mounted devices.
 - 2. Through structural slabs, beams, or columns, unless approved by the Structural Engineer.
 - 3. Concrete topping.
 - 4. Through the same penetrations through floors and walls as mechanical piping unless noted otherwise or if approved by the Engineer.
- N. Place conduits at least 8" away from all hot piping and surfaces including domestic hot water lines.
 - 1. Boxes shall be a minimum of 3" from any process pipes, unless noted otherwise.
- O. Do not mount conduit on mechanical equipment except where necessary to connect electrical devices mounted on the equipment. Provide flexible conduit in all runs "bridging" vibration mountings.
- P. Do not run conduit on or directly in front of access doors, removable panels, equipment removal spaces, control devices, or other spaces necessary for normal maintenance and repair of the equipment.
- Q. Install all exterior underground branch circuit conduits continuously from the source to the load. Do not install in-ground boxes as pull boxes. Oversize the conduits if required.
- R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system. Install exterior underground conduits to drain away from the building.
- S. Provide suitable fittings to accommodate expansion, contraction, and deflection where conduits cross seismic, control and expansion joints. Avoid crossing expansion joints where possible.
- T. Cap or plug conduit ends during construction. Cap or plug ends of conduit that are to remain empty and make watertight. Clean and swab conduits prior to pulling in conductors.
- U. Provide nylon pull string in all empty conduit with a stamped plastic label indicating future use.
- V. Where conduits are stubbed out above walls for use of future or low voltage cabling, provide a bushing on the end of the conduit to protect cabling.
- W. Expansion fittings shall be installed at building expansion joints and where the length of straight run requires it.
- X. Conduit and Penetration Sealing:
 - 1. Seal all conduits where temperature differential between adjacent spaces is greater than 30 degrees Fahrenheit.
 - 2. Seal all conduit penetrations of smoke or fire rated walls or floors with intumescent type fire barriers.

3.3 OUTLET AND JUNCTION BOX INSTALLATION

- A. Maintain accessibility to all outlet and junction boxes as required by the NEC.

- B. Provide recessed outlet boxes in all new construction, except mechanical and electrical rooms. Outlet boxes in mechanical and electrical rooms may be installed exposed.
- C. Provide concealed junction boxes in all new construction, except mechanical and electrical rooms. Junction boxes in mechanical rooms may be installed exposed.
- D. The mounting heights indicated on the drawings are from the center of the outlet box to the finished floor directly below the outlet. Exterior heights are from inside adjacent door, or if no door, from the first floor above grade, unless noted otherwise.
- E. Coordinate the location of all outlets with all drawings before installation. Verify mounting heights and locations of all outlet boxes, including the following:
 - 1. Coordinate device locations with the Owner's final furniture plan(s) before rough-ins. It is advised for the Contractor get a final signed document stating this coordination was performed.
 - 2. Outlets are located on walls with baseboard radiation. Mount to the side of radiation covers.
 - 3. Switch boxes at doors. Verify door swings. Install switchboxes on the latch side of the door if possible.
 - 4. Outlet boxes at casework. Mount outlet boxes above counters and above backsplashes.
 - 5. Outlet boxes at undercounter refrigerators. Mount outlet boxes in the space reserved for the refrigerator.
 - 6. Outlet boxes for microwave units. Mount outlet boxes in the space reserved for the microwave.
 - 7. Outlet boxes adjacent to marker boards or other wall-hung items. Verify top edge and bottom edge of wall-hung items and mount outlets on clear wall space.
- F. Do not mount boxes back-to-back or nipped together.
 - 1. Boxes mounted on opposite sides of a wall shall be mounted on separate studs.
- G. Do not use through-wall boxes unless specifically called out on the plans.
- H. Field-gangable boxes are not allowed. Provide manufactured, multi-gang boxes.
- I. Provide separate switch boxes for lighting dimmer switches to maintain full dimmer rating, if derated wattage/ampere is below the designated circuit ampacity.
- J. Close openings in all outlet boxes during plaster and concrete work with plain paper or slip-on plastic or metal plates.
- K. Provide knockout closures to cap used knockout holes.
- L. Provide FS and FD boxes in wet, damp, and exterior locations.
- M. Maintain vapor barriers around boxes and/or provide suitable boxes listed for use in vapor barriers.
- N. Provide air-tight seals for all boxes in air plenums that can allow air to pass through connecting conduit. Repair all damage to insulation and vapor barriers.
- O. Where boxes and concrete are installed in masonry, provide listed equipment or the means acceptable to the AHJ necessary to provide concrete-tight connections and boxes required by the NEC.
- P. Where receptacle and voice/data or TV boxes are to be provided accessible on the same side of a wall or surface, they shall be provided on the same stud or within 4" of each other.

3.4 INTERIOR PULLBOX INSTALLATION

- A. Provide concealed pull boxes in all new construction, except mechanical and electrical rooms. Pull boxes in mechanical and electrical rooms may be installed exposed.
- B. Terminate all conduits at cabinets and boxes with locknuts and bushings. Provide insulating bushings on all conduit 1" and larger.
- C. Provide pull boxes in accessible locations. Provide accessibility to the pull box cover. Coordinate location of pull/junction boxes with other divisions (trades) prior to installation. Do not locate pull boxes in exposed finished spaces without the specific approval of the Owner Representative.
- D. Provide ½" clear space behind boxes when mounting in wet or damp locations.
- E. Boxes above ACT ceilings shall not be more than 4' from the ceiling. Provide additional supporting hardware and stands to mount equipment if structural ceiling or supports is over 4' from the ACT ceiling.

3.5 CONDUIT BODY INSTALLATION

- A. Provide conduit bodies in accessible locations. Provide accessibility to the cover. Coordinate location of conduit bodies with other divisions (trades) prior to installation. Do not locate conduit bodies in exposed finished spaces without the specific approval of the Owner Representative.

3.6 OPENINGS

- A. Contractor shall review the size and location of all openings to be sure they meet the requirements of the equipment that is furnished and/or installed as a part of this Contract. The contractor shall be responsible for providing all required openings necessary for a complete installation. All required openings are not shown on the Drawings.
- B. All openings shall be filled with an approved sealant, caulking, or grout after the conduit or cable installation is complete.
- C. Openings through grating shall have the bars of the grating banded.
- D. Provide watertight seal around conduit in openings which are approved by the Owner Representative, for all roof, below grade and exterior wall penetrations.
- E. Provide airtight seals for all raceway penetrating air plenums. Repair all damage to insulation and vapor barriers. Seal vapor barriers tight to conduit penetrating vapor barriers.

3.7 IDENTIFICATION

- A. Provide panel and circuit number(s) identification on the cover of all junction boxes and pull boxes located in accessible areas (i.e. above accessible ceilings).
- B. Provide clear, hand-printed lettering using a black permanent marker.
- C. Perform stenciling after the building has been painted so that overspray from building painting does not cover up stenciling performed under this specification section. Re-label any boxes that have been painted over by the painter.

3.8 RACEWAY AND BOXES APPLICATIONS

- A. Apply products as specified below, unless otherwise indicated.
- B. Conceal all conduit work in new construction, except conduit and boxes installed in the following spaces may be run exposed:

1. Mechanical
 2. Electrical
 3. Or other utility type spaces with unpainted and architecturally unfinished walls.
- C. Interior (non-corrosive):
1. Concealed in ceilings, interior walls and partitions: EMT or MC cable if stud wall.
 2. Connection to vibrating equipment; including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment, chillers: FMC
 3. Boxes and enclosures: NEMA 250, Type 1, 12 or 13.
 4. Exposed: EMT.
 5. Areas above acoustical ceilings: EMT or MC cable where specifically allowed per the specifications.

3.9 FLOORBOX INSTALLATION

- A. Install floor box so the finished face is flush with the surrounding floor. Maintain vapor barrier(s) around each floor box.
1. Concrete that is sloped around a box will not be acceptable, box shall be flush with the specified elevation of the room floor, or as recommended by Manufacturer.
- B. Provide multi-gang boxes wherever possible to accommodate all devices within an area. Maintain 24" separation from boxes if multi-gang is not possible, or if the quantity of devices requires more gangs than are available from the floor box manufacturer.
- C. Verify exact locations of floor boxes with the project representative, to ensure the boxes are at the equipment served, and to ensure accessibility.
- D. Poke-Through Service Boxes:
1. Locate fittings as indicated on the drawings. Verify exact core drill location to adhere to the following restrictions:
 2. Install poke-through between concrete re-bars. Do not cut re-bar in floor slab.
 3. Install multiple poke-throughs a minimum of 24 inches apart from each other.
 4. Do not install more than one poke through per 65 square feet in the same structural span unless permitted by the Structural Engineer.
 5. Install poke-throughs where the junction boxes are accessible from the ceiling below.
 6. Install the fittings in accordance with the manufacturer's instructions.
 7. Coordinate with floor covering contractor to complete installation.
- E. Provide an abandonment plug in all unused and/or abandoned holes for poke-through service fittings. In addition, furnish spare plugs to the Owner. The quantity shall not be less than two.
- F. If not noted otherwise on the drawings, provide a 1" conduit from each box compartment ran up the nearest wall and stubbed out above the accessible ceiling. Number of bends in the conduit shall not exceed 270 degrees and the overall length of the run shall not exceed 30'. If the stipulations cause conflict with actual project conditions, Contractor shall contact Engineer prior to installation of conduit and floor.

END OF SECTION

SECTION 26 08 00

TESTING AND COMMISSIONING ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. The requirements of this Section apply to all sections of Division 26.
- B. All equipment checks, adjustments, tests, and system energization shall be performed as specified below. If any test specified will void the warranty of any equipment to be tested, the Engineer shall be notified and further instructions received before proceeding with the test.
- C. When the Work is complete, a final inspection will be made and the Contractor shall demonstrate that all equipment and systems conform to the Drawings and Specifications.

1.2 QUALIFICATION OF PERSONNEL

- A. All personnel responsible for testing and commissioning equipment as a part of this Project shall be specially trained for the tasks they are to perform.
- B. Personnel operating test equipment shall have had previous training and experience in using the equipment and shall be thoroughly familiar with the equipment's capabilities and limitations.
- C. All tests shall be done by or under the direct supervision of service personnel who are trained in the application and operation of the device being tested.
- D. Evidence of the experience of test personnel in the form of certificates of training or other acceptable documentation shall be made available upon request of the Engineer.
- E. The Engineer and Owner reserves the right to require the Contractor to provide different test personnel if those performing the tests do not demonstrate competency in their work.

1.3 COMMISSIONING (BY OWNER)

- A. Owner will provide a commissioning agent outside of this Contract after Contractor performs all verification, testing and adjustments specified in the Contract Documents.
- B. All descriptions of work specified with-in the Contract documents shall be performed by Contractor under this Contract.
- C. Contractor shall make all adjustments to installed equipment as recommended by the Owner's Commissioning agent prior to completion of the project at no additional costs to the project.
- D. Contractor shall notify the Owner's representative when all work has been completed and all testing forms have been submitted to the Commissioning Agent. Contractor shall then provide a minimum of three week notice when project is ready for commissioning. After this time, the Owner's Commissioning agent will be engaged to perform their commissioning work. Contractor shall allow a minimum of an additional three weeks in their schedule for commissioning to be performed.
- E. If it is found all work has not been completed by the Owner's representative or the Commissioning agent, Contractor shall return to the project to complete all work and the time frames as requested above shall reset and the full time frames shall be enforced.

- F. Commissioning agent nor Owner can be held responsible for project delays if adequate notice has not been provided or if all work has not been completed and it is requested the process needs to re-start.
- G. Contractor shall allow adequate time in the construction schedule to perform adjustments and equipment modifications as requested by the Commissioning agent.
- H. Building and project site shall be vacant during the Commissioning processes. Contractor is responsible for coordinating with the Construction Manager to have the building vacant of Contractors and Owner(s), except for the Contractor escorting the Commissioning Agent.
- I. Electrical Contractor shall provide staff who is knowledgeable of the lighting control systems to attend to the site with the Commissioning Agent. This person shall operate and modify controls as requested during the commissioning process. If Contractor representative is not present or does not have adequate knowledge of the control systems, Commissioning will end. Contractor shall work with commissioning agent to reschedule, all time frames will be reset to the full length, and Contractor will be responsible for paying the commissioning agent for the return trip(s).
- J. Fees Contractor is responsible for due to incompleteness or inadequate representation will be deducted from the project retainage.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Miscellaneous testing equipment as detailed.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Test the equipment and systems and demonstrate their proper operation to the Engineer.
 - 1. Do not test equipment until it has been fully prepared, connected, and made ready for normal operation. Repair any equipment damaged by improper operation or testing at no cost to the Owner, before final inspection and acceptance.
- B. Testing equipment used for a given test shall be recommended by the manufacturer for that test and shall be approved by the Engineer.
- C. The Contractor shall provide all test equipment.
- D. All equipment shall be given a thorough visual inspection by the installer to detect insofar as possible any loose or erroneous connections, damaged components, the presence of foreign objects or materials, poor workmanship, incorrect rating of protective devices, or other abnormal conditions.
- E. Every bolted or screwed connection or terminal shall have a torque wrench or torque screwdriver applied to assure tightness before any equipment is energized. This shall apply to both factory-made and field-made connections and terminations. Any problem or damage resulting from a faulty connection or termination shall be the responsibility of the Contractor.
- F. Covers shall be installed on all pull boxes, junction boxes, and raceway fittings before the final inspection.
- G. Refer to each section under Division 26 for additional testing requirements specific to that section.

- H. Contractor shall demonstrate to the satisfaction of the Engineer that all systems are functioning as specified. Contractor shall make all adjustments necessary to obtain the proper operation of the above systems. This shall include but is not limited to adjusting limit switches and level controls; providing the necessary type and quantity of device, relay, and starter contacts; changing wire connections to device contacts; and calibrating signal devices.

3.2 SCHEDULING AND REPORTING

- A. All tests shall be scheduled 48 hours in advance with the Engineer and shall be conducted in his presence or the presence of his representative upon such request. Test results shall be tabulated neatly and legibly on Contractor provided test forms. Test reports shall include the pertinent readings or observations, a description of the method used, and a list of the equipment employed.
- B. If the materials or equipment fail under test, the test reports shall include the following:
 - 1. Pertinent readings or observations made up to the point of failure.
 - 2. Any abnormal readings.
 - 3. Any data which might indicate the cause of failure.
 - 4. The cause of the failure, if determined.
 - 5. Corrective measures taken.
- C. In all cases of test failure, the Contractor shall demonstrate that the corrective measures proposed are adequate before making any repairs, adjustments, or replacements.
- D. 3 copies of all test reports shall be submitted to the Engineer within 24 hours after completion of the test. In addition, 1 complete set of test reports shall be included in each Operation and Maintenance Manual.

3.3 REQUIRED TESTING UNDER DIVISION 26

- A. Contractor to provide the testing of the below:
- B. Overall electrical system
 - 1. Conduct voltage tests at the time of energization of the distribution system. Perform corrective measures as required.
 - 2. Adjust all systems and leave in proper operating condition.
 - 3. Test all wiring and leave free of defective installation and unintentional grounds.
 - 4. Balancing Three Phase Loads:
 - a. Prior to turning the building over to the Owner turn on all equipment in the building, including lighting, and measure the current drawn on each hot leg of feeder supplying each distribution panel. If the current in any one leg varies more than 5% (plus or minus) from the arithmetic average of the current in all the hot legs, reconnect the branch circuits to obtain a balanced loading.
- C. Grounding electrode testing
 - 1. Perform ground resistance testing in accordance with IEEE 142 at the main service grounding electrode when the NEC requires testing.
- D. Receptacle testing
 - 1. Receptacle Testing
 - a. Perform visual test for integrity of each receptacle.
 - b. Verify continuity of each receptacle grounding circuit.
 - c. Verify proper polarity of each receptacle.
- E. Life Safety Lighting System testing
 - 1. Emergency Lighting Relay Testing

- a. Test all emergency switching relays and the Lighting Control Equipment to ensure proper operation during a normal power outage. Coordinate with the generator testing.
 - b. Simulate a power outage at each emergency switching relay by turning off the normal power lighting circuit and observing the operation of the relay, observe that the emergency lighting is energized in the room or area. Verify that the toggle switch in the same room or area cannot turn OFF the emergency lighting if the normal source is not present.
 - c. Simulate a power outage at the lighting control panel(s), and observe that the emergency relays are forced ON, energizing the life safety light fixtures controlled by the lighting control panel(s).
 2. Unit Battery Equipment Testing
 - a. Simulate a power outage at each unit by turning off the normal power and observing the proper operation and duration of each emergency fixture.
 3. Battery Ballast Testing
 - a. Simulate a power outage at each fixture with battery ballasts by turning off the normal power and observing the proper operation and duration of each emergency fixture.
- F. Occupancy sensor testing
1. Upon completion of the installation phase, test and adjust each occupancy sensor to insure proper operation.
 2. Control and testing of occupancy sensors shall be as follows, unless noted elsewhere:
 - a. General rooms and offices: Set the time delay to OFF after 15 minutes of inactivity. Set the sensitivity of each device to trip the lights ON from anywhere in the room, but not so sensitive to trigger the lights on from motion outside the room.
 - b. Corridors and hallway: Set the time delay to OFF after 20 minutes of inactivity. Set the sensitivity of each device to trip the lights ON from anywhere in the corridor/hall.
 3. For dual technology sensors, set the sensor to maintain an ON condition if either technology is triggered from within the room after an initial ON. Set the device to initiate an ON condition only if both technologies sense motion from within the room.
 4. Test all operational features of the system at this time.
 5. Where required, make appropriate correction(s) and adjustments.
- G. Daylight sensor Testing
1. Upon completion of the installation phase, test and adjust each daylight sensor to insure proper operation.
 2. Test all operational features of the system at this time.
 3. Where required, make appropriate correction(s) and adjustments.
 4. Specific adjustments:
 - a. At night (or with the shades closed) set a digital light meter at floor level, and while increasing the light level in the space, set the ON, OFF and deadband footcandle setpoints to the levels specified.
 5. Repeat adjustments for all spaces.
- H. Generator Testing
1. Connect the Owner's portable generator and test all equipment under generator power.
 2. Verify all systems operate under the generator power.
 3. Simulate a power fail and connect the building to generator power.
 4. Verify all systems operate appropriately and all programmed equipment retained setpoints through the power outage.

5. Owner will provide the generator and fuel for the testing period. Contractor shall provide Owner a minimum of a 2-week notice prior to testing.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Lighting and appliance panelboards.
- B. Installation.
- C. Identification.

1.2 QUALITY ASSURANCE

- A. All panelboards and components provided shall be of the same manufacturer.

PART 2 EQUIPMENT

2.1 LIGHTING AND APPLIANCE PANELBOARDS

- A. A new panelboard will not be supplied under this project. New circuit breakers to be provided in existing panelboards per the Contract Documents.
- B. Circuit Breakers:
 - 1. Provide molded case, non-adjustable, thermal-magnetic, quick-make, quick-break, plug-on or bolt-on type circuit breakers to match existing.
 - 2. Provide multi-pole breakers when indicated on the schedules.
 - 3. Breaker handle ties on single pole breakers are not acceptable.
 - 4. Tandem breakers are not allowed.
 - 5. Provide circuit breakers with engraved ratings on the handle that are visible without removing the panel cover.
 - 6. GFCI rated breakers:
 - a. Class A GFCI protection, HACR rated.
 - b. Sense current imbalance of 4 milliamps or greater.
 - c. Ground fault sensor to trip the circuit upon current imbalance.
 - d. Test pushbutton on breaker.
 - e. Trip indicator.
 - f. 1-pole breakers rated 15-30 amperes.
 - g. 2-pole breakers rated 15-60 amperes.
 - 7. AFCI rated breakers:
 - a. Trip indicator.
 - b. HACR, SWD rated.
 - c. Test pushbutton on breaker.
 - d. Selective arc trip sensing.
- C. Acceptable Manufacturers:
 - 1. To be from the manufacturer of the existing panelboard of which the breaker is to be installed at.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide HACR, GFCI and AFCI rated breakers which meet the requirements of NFPA 70 in addition to when noted on the panelboard schedules.

- B. Panelboard schedule designations are as follows:
 - 1. Blank: Not intended for use.
 - 2. Space: Contains necessary bus and hardware for future addition of breakers.
 - 3. Spare: Contains a complete breaker installed, size as shown on schedule.
- C. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to/from other enclosures or devices.

3.2 GROUNDING

- A. Provide grounding per Section 26 05 26: Grounding and Bonding for Electrical Systems.

3.3 IDENTIFICATION

- A. Update the existing panelboard schedules to identify the modified and new circuits.

END OF SECTION

SECTION 26 24 19

MOTOR CONTROL

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Section includes:
 - 1. Manual motor starters.
 - 2. Installation.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

1.3 COORDINATION

- A. Coordinate features, accessories, and functions of each controller and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.
- B. The contractor shall verify that the equipment being furnished can be installed in the available space. If available space is not adequate for the proposed equipment, Contractor shall notify the Engineer before releasing the equipment for manufacturing. The contractor shall be responsible for correcting equipment spacing conflicts which were not identified and coordinated with Engineer prior to releasing the equipment for manufacturing.

PART 2 PRODUCTS

2.1 MANUAL MOTOR STARTERS

- A. Manual starters shall be provided to control and protect 120-volt, single phase motors. They are identified on the Drawings as "MS."
- B. Starters shall be 120-volt, single pole with overload heater sized for the motor nameplate current.
- C. The starter shall be mounted in a 2-gang FD box with single gang openings.
- D. ON-OFF identified on operator cover.
- E. Manufacturer:
 - 1. General Electric CR101Y.
 - 2. Cutler-Hammer MS.
 - 3. Square D FG5.
 - 4. Or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive equipment with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

- B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- C. Examine enclosures before installation. Reject enclosures which are wet, moisture damaged, or mold damaged.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install equipment in accordance with the NEC, as shown on the Contract Documents, and as recommended by the manufacturer.
- B. Install fuses if not factory installed.
- C. Install equipment in accordance with manufacturer's instructions.
- D. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.
- E. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.
- F. Install wiring between equipment and remote devices as specified and as required for the control specified in other sections.
- G. After the equipment has been energized, an authorized service person with knowledge of the supplied controller, motor, and project control equipment shall perform the following:
 - 1. Make all final settings and parameter adjustments.

3.3 OVERLOAD PROTECTION

- A. Before any motor is energized, Contractor shall obtain the nameplate information from the motor supplier. The nameplate current of all motors shall be recorded in the O&M manuals. Where a one-line diagram is provided, record the full load ampere rating in the space under the motor labeled as "FLA_____."
- B. Overload relays shall be checked for correct class and setting in accordance with motor manufacturer's recommendations. Class 10 overload relays shall be provided unless the motor manufacturer specifies otherwise.
- C. Motor overload settings shall be in accordance with the starter manufacturer's recommendation for the given motor nameplate current, service factor and power factor correction capacitors, if provided. Contractor shall be responsible for all damage that results from improper overload protection.
- D. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

3.4 IDENTIFICATION

- A. Provide warning signs as required by the NEC and when noted in the specifications.
- B. Label each enclosure-mounted control and pilot device.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Lighting Control Devices.
- B. Convenience receptacles.
- C. Range receptacles.
- D. Wall plates.

1.2 SUBMITTALS

- A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.
- B. Submittals for pre-approval shall be submitted 2 weeks prior to the bid date. Manufacturers of equipment looking for approval shall schedule a demonstration meeting at the Engineer's office to demonstrate the capabilities and quality of the devices. This meeting shall be scheduled 2 weeks prior to the bid date. Manufacturer/Contractor is responsible for scheduling around Engineer's prior engagements.

1.3 QUALITY

- A. All wiring devices shall be products of the same manufacturer, unless specifically noted otherwise.

1.4 DEVICE COLORS

- A. White wiring devices for all wall mount devices.
- B. Wiring devices mounted on or flush to a finished ceiling shall match the color of the ceiling.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES

- A. Switches:
 - 1. Heavy-duty, specification grade.
 - 2. Quiet, toggle type.
 - 3. Side and back wired.
 - 4. Rated 20 amperes under all loads, 1 HP at 120 volts, 2 HP at 240 volts.
 - 5. Single-pole, 2-pole, 3-way and/or 4-way as shown on the Drawings.
 - 6. Approved Manufacturers:
 - a. Cooper.
 - b. Hubbell.
 - c. Leviton.
 - d. Pass & Seymour.
 - e. Lutron.
- B. Low Voltage Dimmer:
 - 1. For use in spaces with automated controls such as vacancy/occupancy detection, time of day and day light controls.

2. Provide solid state, suitable for mounting behind a standard depth faceplate and for operation on common neutral circuits.
 3. Provide sufficient capacity dimmer to accommodate the connected load of the light fixtures controlled by the dimmer.
 4. Suitable for single-pole, 3-way and 4-way switching.
 5. Electrostatic discharge protection.
 6. Four pushbuttons for control to consist of:
 - a. On
 - b. Off
 - c. Dimming Up
 - d. Dimming Down
 7. Preset feature to return lights to previous light level when turning the lights on.
 8. Button function shall be identified with manufacturer engraving or similar means.
 9. 0-10 volt or luminaire compatible control signal directly proportional to the desired light levels. Signal source method and control signal shall be coordinated with the controlled luminaires.
 10. Approved Manufacturers:
 - a. Lutron.
 - b. Leviton.
 - c. Cooper/Arrow Hart.
 - d. Hubbell.
 - e. Pre-approved equal.
- C. Low Voltage Button Switch:
1. For use in spaces with automated controls such as vacancy/occupancy detection, time of day and day light controls.
 2. Provide solid state, suitable for mounting behind a standard depth faceplate and for operation on common neutral circuits.
 3. Suitable for single-pole, 3-way and 4-way switching.
 4. Electrostatic discharge protection.
 5. Two pushbuttons for the following control:
 - a. On
 - b. Off
 6. Button function shall be identified with manufacturer engraving or similar means.
 7. Luminaire compatible control signal directly proportional to the desired light levels. Signal source method and control signal shall be coordinated with the controlled luminaires.
 8. Approved Manufacturers:
 - a. Lutron.
 - b. Leviton.
 - c. Cooper/Arrow Hart.
 - d. Hubbell.
 - e. Or equal.
- D. Occupancy/Vacancy Sensors, Ceiling Mount:
1. Dual sensing technologies, including passive infrared and either ultrasonic or sound detection.
 2. Sensor shall be designed so the use of the dual technologies activates the sensor without erroneous activations and detection of occupancy by either technology shall hold the lights on.
 3. 30-second to 30-minute adjustable time delay to turn off lights.
 4. Dense, wide angle coverage pattern.

5. UL listed for use of line voltage or low voltage systems.
 6. Provide dry contacts internal to the device and/or separate relay packs to perform the specified control.
 7. Provide a single dry contact for use of the HVAC control system. Contact to be energized anytime the occupancy sensor senses motion. Sensors in the following rooms are to be provided with this:
 - a. Classrooms
 - b. Lobby
 - c. Hallways
 - d. Restrooms
 8. Provide all power supplies and mounting hardware.
 9. Single-pole, 2-pole, 3-way and/or 4-way to perform the specified lighting control.
 10. Approved Manufacturers:
 - a. Watt Stopper.
 - b. Sensor Switch.
 - c. Leviton
 - d. Lutron
 - e. Cooper
 - f. Hubbell.
 - g. Pre-approved equal.
- E. Occupancy/Vacancy Sensors, Wall mount:
1. Dual sensing technologies, including passive infrared and either ultrasonic or sound detection.
 2. Sensor shall be designed so the use of the dual technologies activates the sensor without erroneous activations and detection of occupancy by either technology shall hold the lights on.
 3. 30-second to 30-minute adjustable time delay to turn off lights.
 4. Dense, wide angle coverage pattern.
 5. UL listed for use of line voltage or low voltage systems.
 6. Provide dry contacts internal to the device and/or separate relay packs to perform the specified control.
 7. Provide a single dry contact for use of the HVAC control system. Contact to be energized anytime the occupancy sensor senses motion. Sensors in the following rooms are to be provided with this:
 - a. Classrooms
 - b. Offices
 - c. Lobby
 - d. Hallways
 - e. Restrooms
 8. Provide all power supplies and mounting hardware.
 9. Single-pole, 2-pole, 3-way and/or 4-way to perform the specified lighting control.
 10. Integral push button to override occupancy sensor controls:
 - a. Activation of button when lights are off shall turn lights on.
 - b. Activation of button when lights are on shall turn lights off.
 - c. Sensing technology shall control lights as specified above after a button has been pressed.
 - d. Provide device with multiple buttons for spaces with multilevel/step and/or multizone lighting.

11. Approved Manufacturers:
 - a. Watt Stopper.
 - b. Sensor Switch.
 - c. Leviton
 - d. Lutron
 - e. Cooper
 - f. Hubbell.
 - g. Pre-approved equal.

2.2 CONVENIENCE RECEPTACLES

- A. Duplex receptacles:
 1. Specification grade, 3-wire grounding type, NEMA 5-20R.
 2. Side wired.
 3. Rated 20 amperes, 125 volts.
 4. In addition to when noted in the Contract Documents, tamper resistant devices shall be provided where required by the NEC and other governing codes.
 5. Spring type grounding strap that holds mounting screws captive.
 6. Approved Manufacturers:
 - a. Cooper.
 - b. Hubbell.
 - c. Leviton.
 - d. Pass & Seymour.
- B. Ground Fault Circuit Interrupter Receptacles:
 1. Specification grade, 3-wire grounding type, NEMA 5-20R.
 2. Side wired.
 3. Rated 20 amperes, 125 volts.
 4. In addition to when noted in the Contract Documents, tamper resistant devices shall be provided where required by the NEC and other governing codes.
 5. LED trip indicator.
 6. Approved Manufacturers:
 - a. Cooper.
 - b. Hubbell.
 - c. Leviton.
 - d. Pass & Seymour.

2.3 DATA AND VOICE MODULAR JACKS

- A. Provide telephone (desk) and data outlet devices with the following specifications:
 1. Plastic modular 8 pin, 8-conductor outlet jack with insulation displacement connectors (IDC)
 2. ANSI/EIA/TIA-568-B.2 Category 6/6A compliant (extended performance)
 3. T568A pin/pair wire map
 4. Provide the following color scheme for outlet devices:
 - a. Voice Modular Jacks: White
 - b. Data Modular Jacks: Blue
 - c. Approved Manufacturers:
 - 1) Leviton.
 - 2) Hubbell.
 - 3) CommScope/Uniprise.
 - 4) Pre-approved equal.

- B. Provide wall telephone outlet devices (VoIP) with the following specifications:
 - 1. Plastic modular 8 pin, 8-conductor outlet jack with insulation displacement connectors (IDC)
 - 2. ANSI/EIA/TIA-568-B.2 Category 6/6A compliant (extended performance)
 - 3. T568A pin/pair wire map
 - 4. Approved Manufacturers:
 - a. Leviton.
 - b. Hubbell.
 - c. CommScope/Uniprise
 - d. Pre-approved Equal
- C. Provide network devices that terminate to HVAC equipment with the following specifications:
 - 1. Plastic modular 8 pin, 8-conductor outlet jack with insulation displacement connectors (IDC)
 - 2. ANSI/EIA/TIA-568-B.2 Category 6/6A compliant (extended performance)
 - 3. T568A pin/pair wire map
 - 4. Provide the following color scheme for cabling and terminations:
 - a. HVAC equipment terminations: Purple/Violet
 - b. Approved Manufacturers:
 - 1) Leviton.
 - 2) Hubbell.
 - 3) CommScope/Uniprise.
 - 4) Pre-approved equal.
- D. LAN jack labeling scheme is as follows:
 - 1. [closet #] [patch panel (letter)] [patch-jack #] (i.e. "3C23" would indicate cabling closet number "3", patch panel "C", and patch panel jack "23.")
 - 2. Patch panels in cabling closets must be labeled with "far end" room numbers.

2.4 COVERPLATES

- A. Interior Coverplates: Provide new cover plates over all boxes with the following minimum specifications:
 - 1. All finished areas and unfinished areas with recessed boxes: smooth, impact resistant thermoplastic or molded nylon wall plates.
 - 2. Unfinished areas over surface mounted boxes:
 - a. Surface mounted switches and receptacles in FS or FD cast device boxes provide raised metal cover to match the surface metal box.
 - b. Surface mounted switches in cast aluminum boxes shall have stainless steel cover plates with dimensions which match the box dimensions.
 - 3. Provide appropriate covers for special purpose receptacles.
- B. Wall plates for switches or manual starters which serve exhaust fans shall be engraved "EXHAUST FAN" with 1/8-inch-high black letters.

PART 3 EXECUTION

3.1 WIRING DEVICES

- A. Provide new devices for all outlets indicated.
- B. Provide individual GFCI devices for each duplex receptacle in ganged outlets.
- C. Mount all receptacles with the ground pin on the bottom.

- D. Replace all receptacles and plates that have been damaged or discolored during construction, prior to Substantial Completion.
- E. Install wall plates after all the painting has been completed.
- F. Mount wall mounted dimmers in separate boxes from switches.
- G. Test all wiring devices for continuity, proper polarity connections, and grounding.
- H. Switches and convenience outlets shall be provided where shown on the Drawings.
- I. Mounting Heights: dimensions are to the center of the outlet box:
 - 1. Lighting control devices shall be on the latch side of doors, located 4 feet above floor, unless noted otherwise.
 - a. Door swing shall be verified with door installer before installing switch outlet boxes.
 - 2. Receptacle outlets in the finished area shall be mounted 18 inches above floor, unless noted otherwise.
 - a. Where receptacles are to be installed on walls shared with a wall mounted radiation unit, receptacle shall be mounted so that the bottom of the receptacle box is 2" above the radiation unit.
 - 3. Interior surface mounted receptacles shall be mounted at 4 feet above floor level, unless noted otherwise.
- J. For all receptacles to be installed above counters installed above counters or worktables shall be mounted with short dimension parallel to the floor. Contractor shall verify countertop heights before installing boxes for convenience receptacles.
- K. All receptacle outlets and lighting control devices shall be grounded to a grounding conductor that has green insulation.
- L. All lighting control devices, convenience receptacles, data outlets, manual starters, etc. in the finished areas shall be flush mounted. Flush boxes shall fit flush with the final finished wall in every case. Install metal box extenders and bond to the box where necessary.
- M. All boxes shall be plumb.
- N. All receptacles on a GFCI breaker shall be identified with laminated plastic nameplates which read: "GFCI PROTECTED." Letters shall be 1/4-inch-high white on a red background. Feed through type GFCI receptacles which feed non-GFCI type receptacles when shown as GFCI type receptacles on the Contract Documents are not allowed, unless noted otherwise.
 - 1. For double-duplex and other multi-gang receptacles, one of the receptacles is to be a GFCI type receptacle and the remaining receptacles in the shared box may be fed through.
- O. Contractor shall be responsible for providing GFCI and Arc fault protection where required per the NEC. Not all instances may be shown on the Contract Drawings. Protection may be provided either via an accessible wall device or a rated breaker at the feeding panelboard. Installation of a blank wall device with protection features to feed devices without the protection features will not be allowed, unless specifically noted in the Contract Documents.

3.2 OCCUPANCY AND LIGHT LEVEL SENSORS

- A. Where occupancy sensors, daylight, or photocell sensors are to be used, Contractor shall provide a guarantee of sensor coverage and operation for the Contractor's proposed sensors and layout. It is the responsibility of the Contractor to work with the proposed manufacturer or product representative to determine sensor layout and quantities. The indicated sensor layout in the Contract Documents shall be revised to meet the manufacturer's recommended layout and sensor locations to achieve the guarantee of sensor coverage and operation.

- B. If the Owner has a nuisance tripping problem for any lighting zone controlled by such sensor it is the Contractor's responsibility to resolve the issue. Contractors shall adjust the sensor settings such as sensitivity levels and time delays.
- C. If it is determined the sensor is in a troublesome location such as mounted too close to windows, grills, HVAC equipment, fans, etc. The contractor shall move the device to a new location as recommended by the manufacturer.
 - 1. Occupancy/Vacancy sensors shall not be mounted 4' or closer to heaters, diffusers, air returns and other mechanical equipment.
- D. Where it is determined the quantity of supplied sensors is not sufficient, Contractor shall add additional sensors to offer the specified control without erroneous tripping, false offs or slow activations.
- E. If Owner and Engineer determine the installed model or type of sensor provided is inadequate for the space usage or is unable to provide the specified control, Contractor shall replace the sensor(s) with a different model and/or manufacturer at request of Owner at no additional cost. If additional sensors are needed to provide the adequate coverage per the new manufacturer or model recommendations, Contractor shall install the additional sensors at no additional cost to Owner.
- F. All sensor work shall be included in the bid/quote amounts. Contractors will not be awarded additional services to perform troubleshooting, programming, installations, repairs, relocations, etc. or any other work associated to the sensing devices in relation to delivering the specified lighting controls.

3.3 WALLBOX DIMMERS

- A. Where dimmers are shown ganged with other dimmers and/or other devices, size outlet such that dimmers will not be underrated. Provide separate boxes if necessary.

3.4 COVERPLATE IDENTIFICATION

- A. Provide ¼" high engraved, black-infilled lettering laser etching engraved cover plates or thermal machine printed labels which are permanently installed.
 - 1. This requirement is for all receptacle and lighting devices.
- B. Provide identification on the plate immediately above the wiring device on the backside of the cover plate, unless noted otherwise.
- C. For floor box devices, provide a thermal machine printed label on the underside of the floor box cover.

END OF SECTION

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SECTION 26 51 00

LIGHTING

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Luminaires.
- B. Drivers.
- C. Installation.

1.2 SUBMITTALS

- A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Division 26.
- B. Submit shop drawings in booklet form with separate sheet for each luminaire assembled in alphabetical order by 'type'. Submit manufacturer's data including dimensioned drawings and photometric data prepared by an independent nationally recognized testing lab.
- C. Submit shop drawings for each ballast type and lamp as specified and/or indicated on the drawings.
- D. Provide photometric data for each luminaire and a photometric analysis of each space where Contractor proposes using luminaires which is not listed in the Contract Documents or which does not have prior approval. Contractor shall assume full responsibility for scheduling and timing for the analysis. The following information shall be displayed in the analysis and Contractor shall modify the analysis and change data used upon request from Engineer/Owner at no additional cost or project schedule change.
 - 1. Illumination levels in foot-candles.
 - 2. Analysis/Calculation grid shall be suitable for the project area to give a realistic feel for the space and shall be readable.
 - 3. Height of analysis/calculation surface(s) in the model.
 - 4. Light Loss factor for each luminaire.
 - 5. Initial delivered lumens for each luminaire and lamp.
 - 6. Statistics for each space/area: Average, Maximum, Minimum, Max/Min Ratio, Avg/Min Ratio.
 - 7. Where the measured light levels of the installed luminaires does not meet or exceed the Contractor's photometric analysis, Contractor shall replace luminaires with the specified luminaires or other approved luminaire which meets the proposed light levels.
- E. Samples:
 - 1. Contractor shall upon written request by the consultant, provide samples of any custom made components suitable for evaluation.
 - 2. Contractor shall upon written request by the consultant, provide samples of standard system components or software suitable for evaluation.

3. Samples submitted in accordance with this section will be returned to the contractor following evaluation.

1.3 DESIGN CRITERIA

- A. Where switching circuit designations are not identified in the Contract Documents, the area lighting system shall be controlled by the device(s) shown in the space.
- B. Multiple lighting control zones in a shared space are identified in the Contract Documents with the use of switch designations.
- C. The lighting control system shall be listed, approved, and comply as required with all governing energy codes and ordinances.
- D. Refer to Section 26 51 13 for lighting control systems.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Provide luminaires with lamps, for each outlet specified in the Contract Documents.
- B. Reference luminaire schedule in the Contract Documents.
- C. Provide U.L. labeled luminaires.
- D. The luminaire types required are as noted by a capital letter(s) and number(s) on the Drawings. Contractor is solely responsible for the exact quantities. Luminaire shapes shown on the Contract Documents do not necessarily equate to an exact length or quantity of luminaire; rather, the luminaire designation shown on the plans refer to the type of luminaire. It is the Contractors responsibility to provide the proper length and switching configuration in each space.
- E. Provide disconnects at each luminaire as required by the NEC.
- F. Unless indicated otherwise, provide color stabilized clear virgin acrylic diffusers for interior luminaires. Provide a minimum thickness of 0.156" for all troffer lenses.
- G. Unless indicated otherwise, refer to architectural documents for mounting heights of wall mounted, pendant mounted or hung luminaires.

2.2 DRIVERS

- A. LED Drivers:
 1. UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual (UL SAM).
 2. Class A sound rating.
 3. Minimum operating ambient temperature of -40 degrees C.
 4. Life expectancy of 75,000 hours or greater at an average ambient temperature of $\leq$ 40 degrees C with use of the luminaire it is supplied with.
 5. Self-rise of 25 degrees C at maximum load in open air without heat sink.
 6. Certified by UL for use in a dry or damp location (Outdoor Type I).
 7. Tolerates sustained open circuit and short circuit output conditions without damage.

8. Allowable case temperature up to 85 degrees C.
9. Reduce output power to LEDs if maximum allowable case temperature is exceeded.
10. Driver complies with governing FCC rules and regulations.
11. Tolerate sustained open circuit and short circuit output conditions without damage and need of external fusing or trip devices.
12. Dimmable, controlled by 0-10V low voltage controller or other means compatible with lighting system controls.
13. Manufacturer shall have a 5-year history of producing LED lighting drivers for the North American market.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide all hangers, rods, mounting brackets, supports, frames, etc. for proper and safe luminaire installation. Install all luminaires in accordance with manufacturers' recommendations and instructions. Refer to Section 26 05 29: "Supporting Devices" for approved supporting methods. Type of ceilings shall be verified so proper mounting hardware is furnished with each luminaire.
- B. In general, luminaires shall be located where shown on the Contract Documents; however, Contractor shall check equipment locations and install luminaires so that piping, duct work, and other devices or equipment shall not interfere with the luminaire components or its performance.
- C. Provide luminaires complete with all auxiliaries required for proper, safe and distortion free installation in the various ceiling constructions in which they appear. Coordinate ceiling types with the Architectural drawings and provide compatible luminaires.
- D. Location of insulation above ceilings shall be verified where recessed luminaires are located. If insulation is present, Contractor shall provide IC rated luminaire or install barrier to separate luminaires from insulation per manufacturer's recommendations.

3.2 WIRING

- A. Wire all recessed lay-in luminaires with 6 feet of flexible MC cable to a junction box.
- B. Provide grounding type connectors for all conduit and cable.
- C. Provide a neutral (grounded) conductor with each switching circuit.
- D. Provide an insulated grounding conductor with each lighting circuit.

3.3 QUALITY CONTROL

- A. At the time of substantial completion, all luminaires must be installed and lamped with new lamps. Install all luminaires complete with lenses, diffusers, reflectors, louvers, and other required accessories. Furnish a minimum of one case of replacement lamps for each type and size lamp used. Deliver replacement stock to the Owner's storage space as directed by the Owner.
- B. Lenses, refractors, and glassware shall be clean and free from cracks or chips. All reflectors, shades, luminaire bodies, etc. shall be free from dents and scratches.

Replace any damaged reflectors, diffusers, louvers, or other components at no expense to the Owner.

- C. Clean all luminaires free of dust, fingerprints, paint, etc.. All exposed tags and labels other than UL and emergency ballast identifiers shall be removed.
- D. Replace all defective drivers within the guarantee period at no cost to the Owner.

3.4 LIGHTING REBATE PROGRAM

- A. Apply the Utility energy lighting rebate to this project. Secure on behalf of the Owner the maximum rebate. Include all negotiations and substantiation required.

3.5 IDENTIFICATION

- A. Lighting control components shall be identified by laminated plastic nameplates with 1/4-inch white lettering on a black background. Identify each lighting contactor based on the loads served. In addition, identify the lighting control panels as such.
- B. Each interior LED luminaire shall be provided with an adhesive label on the outside of the housing but concealed from normal view, such as above an ACT ceiling, or on the driver housing. Label shall identify the following items:
 - 1. Date of installation
 - 2. Rated Lumen output
 - 3. Rated Color Temperature
 - 4. Rated input wattage

END OF SECTION

SECTION 26 51 43

LIGHTING OPERATIONS

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. System Description
- B. System Operation
- C. Control Devices
- D. Installation

1.2 REFERENCES

- A. Section 26 05 00: Common Work Results for Electrical
- B. Section 26 05 33: Raceways, Fitting and Boxes
- C. Section 26 51 00: Lighting
- D. Section 26 27 26: Wiring Devices

1.3 SUBMITTALS

- A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.
- B. Provide a complete shop drawing package of the system.
- C. Provide clearly legible shop drawings.
- D. Indicate short circuit current rating of all equipment.
- E. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.
- F. Submit wiring diagrams for all components including but not limited to, relay panels, relays, controls, etc.
- G. Submit physical drawings of components.
- H. Shop drawings not containing all the information listed above will be rejected without review.
 - 1. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.
 - 2. Provide a complete proposed system description.
 - 3. Provide single line riser diagram and floor plan depicting location of every device in the proposed system.
 - 4. Provide diagram(s) depicting equipment mounting racks and the location of all equipment and devices to be mounted therein.

5. Provide diagram(s) depicting wall mounted equipment including the associated cable routing and power requirements.
 6. Contractor shall provide equipment panel elevations for each lighting panel or lighting panel group. Elevations to indicate component layouts, cable routing and terminal blocks.
 7. Contractor shall provide complete engineering drawings of all custom-made components indicating all materials, gauges, dimensions, finishes and wiring diagrams.
- I. Review of shop drawings does not vacate responsibility of contractor to provide a functioning system meeting the Owner's requirements.
 - J. Operating Manuals to be furnished as specified in Division 1, Division 26 and herein:
 1. Contents:
 - a. Product data for all equipment.
 - b. General Operation instructions for all functions in all rooms and combinations of rooms.
 - c. Light duty maintenance troubleshooting guide.
 - d. Manufacturer supplied maintenance documentation including parts lists, precautionary information, maintenance procedures and warranty information.
 - e. Completed Commissioning Checklists.

1.4 GENERAL SYSTEM REQUIREMENTS

- A. Provide complete lighting system as described herein and as shown on the Contract Documents.
- B. Preference of the Owner is not to have a master control system and to treat each space as a separately controlled unit.
- C. In areas where a single switch circuit is to be provided, such as offices, restrooms, storage rooms, utility rooms, the use of local line voltage control devices not tied to a controller or low voltage control systems will be allowed if such proposed devices offer the control as specified in the Contract Documents. Where diming and specialized controls are required, Contractor may provide a control module in the individual space to offer the type of control as specified.
- D. Wireless control systems will not be allowed. All controls, modules, switches, etc. shall be hardwired.
- E. Multiple lighting control zones in a shared space are identified in the Contract Documents with the use of switch designations.
- F. Where switching circuit designations are not identified in the Contract Documents, all luminaires in the area shall be controlled by the device(s) shown in the space.
- G. Where multiple occupancy sensors are used for control in a common control zone, activity sensed by any sensor shall reset the off-time delay.
- H. Contractor shall provide all equipment and work to perform the lighting control as described in the Contract Documents.
- I. The lighting control system shall be listed, approved, and comply as required with all national, state and local energy codes.
- J. Comply with NEC and all local and state codes as applicable to electrical wiring work.
- K. If the lighting control device loses communication with the lighting control device, control module, or control system, or if a device fails, the lights in the zone shall fail to 100% on.

1.5 SYSTEM OPERATION

- A. Contractor shall provide lighting controls and associated equipment, and work required to perform the lighting operations specified here-in.
- B. In addition to the control specified below, anytime the occupancy or vacancy sensors in a space detect occupancy, a single dry contact in the space shall be activated for the HVAC control system.
- C. Occupancy Control:
 - 1. When an occupant enters the space, the occupancy sensor(s) shall detect occupancy and automatically turn the lighting on.
 - 2. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
 - a. Occupancy sensor time delay off shall be initially set at the time delays specified.
 - 3. Spaces which shall be provided with this control are as follows:
 - a. Restrooms – 30 minutes
 - b. Toilet Rooms – 30 minutes
 - c. Hand Washing Station areas – 30 minutes.
- D. Occupancy Control and Dimming:
 - 1. When an occupant enters the space, the occupancy sensor(s) shall detect occupancy and automatically turn the lighting on to the previous light level setpoint.
 - 2. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
 - a. Occupancy sensor time delay off shall be initially set at the time delays specified.
 - 3. Occupant may adjust light level using the wall mounted dimmer device.
 - 4. Spaces which shall be provided with this control are as follows:
 - a. IT Work Area Rm C207 – 30 minutes.
- E. Vacancy Control
 - 1. When an occupant enters the space, the occupancy shall use the wall mounted lighting control device to manually turn the lighting on.
 - 2. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
 - a. Occupancy sensor time delay off shall be initially set at the time delays specified.
 - 3. Occupant may utilize the wall mounted lighting control device to turn the lighting off prior to the automatic sensor turning the lighting off.
 - 4. Spaces which shall be provided with this control are as follows:
 - a. Storage Rooms – 10 minutes.
- F. Vacancy Control and Dimming:
 - 1. When an occupant enters the space, the occupancy shall use the wall mounted lighting control device to manually turn the lighting on.
 - 2. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
 - a. Occupancy sensor time delay off shall be initially set at the time delays specified.
 - 3. Occupant may adjust light level using the wall mounted dimmer device(s).
 - 4. Occupant may utilize the wall mounted lighting control device to turn the lighting off prior to the automatic sensor turning the lighting off.
 - 5. Spaces which shall be provided with this control are as follows:
 - a. Medium Group Room G109 – 30 minutes
 - b. Office Rm C207A – 30 minutes

- c. SRO Office C117A – 30 minutes

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all Equipment in accordance with manufacturer's recommendations. Provide complete system as indicated on the drawings. Make all necessary wiring connections to internal/external devices.
- B. Where occupancy sensors are to be used, Contractor guarantees sensor coverage and operation for the Contractor's proposed sensors and layout. If Owner has a nuisance tripping problem for any lighting zone controlled by an Occupancy sensor it is the Contractor's responsibility to replace the sensor. If Owner and Engineer determine the model or type of sensor provided is inadequate for the space usage, Contractor shall replace the sensor with a different model and/or manufacturer at request of Owner at no additional cost.
- C. Contractor shall hold coordination meetings with Electrical Contractor, Mechanical Systems Contractor, and Lighting Control Systems equipment provider. Meeting length and frequency shall be as required, with a minimum of one meeting between trades to ensure system equipment, locations, mounting, and cabling requirements are fully coordinated before installation begins. Contractor shall be responsible for any additional costs required to make corrections or additions in the field for a fully installed and operating system due to conflict of Contractor assumptions and/or conflict of materials provided. Contractor shall provide meeting minutes and a signed attendance sheet of the meeting upon request of Owner or an Owner representative.
- D. Where designated as 'NL' in the Contract Documents, luminaires are intended as 'night lighting' and is intended for 24-hour operation and shall be unswitched.

3.2 START-UP RESPONSIBILITY

- A. The Contractor shall initiate system operation. Trained start-up personnel shall be provided on each consecutive working day until the system is fully functional and ready to start the testing phase.
- B. Properly ground each piece of electronic equipment prior to applying power. Any equipment damaged due to improper ground shall be replaced by the Contractor at their expense.
- C. Properly ground all shielded wire shields to the appropriate earth ground.
- D. All systems, equipment, and devices shall be in full and proper adjustment and operation and properly labeled and identified.
- E. All materials shall be neat, clean, and unmarred and parts securely attached.
- F. All surfaces shall be restored to their original appearance and condition after installation.
- G. Contractor shall notify the Owner's Representative when the start-up phase is complete, and the system is functioning as required per specifications. The Owner's Representative will then notify the Contractor when the testing phase is ready to begin.

3.3 TESTING

- A. A trained technician shall be present when the system is put into service and shall certify to the Engineer/Owner that all equipment has been installed correctly and is operating properly.
- B. Technician shall make all modifications necessary to obtain proper operation of the system.
 - 1. Verify that all wiring connections are complete and correct.
 - 2. After installation and before termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields.
 - 3. Test for and eliminate ground loops that may result from use of different power sources for various components.
 - 4. Complete system software programming.
 - 5. Test relays and switches after installation to confirm proper operation and confirm correct loads are recorded on directory card in each panel.
- C. All functions and features to be tested as a complete system and corrections made at no cost to the Owner.
- D. All devices shall be calibrated to obtain the specified function and to reach the specified foot-candle level.
- E. Contractor shall notify the Owner's Representative when testing is complete, and the system is functioning as required per the Contract Documents. The contractor shall then coordinate with the Owner's Representative a time for the Owner's Review phase.

END OF SECTION

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SECTION 26 52 00
EMERGENCY LIGHTING

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Unit Battery Equipment.
- B. Exit Signs.
- C. Installation.

1.2 SHOP DRAWINGS

- A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

1.3 QUALITY CONTROL

- A. Where battery back-up units are indicated to be installed, battery back-up units must be installed in a manner that will allow the units to be accessible for maintenance and testing; remote testing capability shall be provided where units cannot be made readily accessible as defined by the NEC.
- B. Egress and emergency lighting levels shall be verified during testing by Contractor. Systems to meet minimum lighting levels required by the governing codes for a period of 90 minutes.
- C. Prior to installation of exit signs and emergency egress lighting, Contractor shall contact the Building Official and Fire Marshal to arrange a walk-through to discuss exit sign and emergency lighting placement, approximately at the mid-point of construction. Contractor will be held responsible for cost to modify and/or add egress lighting and exit signs after wall and ceilings are covered.

1.4 BUILDINGS WITH PERMANENT MOUNTED GENERATOR

- A. Reduce or eliminate the use of battery backup devices in buildings utilizing generators; connect all exit and emergency lighting to the building generator.
- B. Lighting circuits tied to generator power shall be switched with the general lighting in the space unless designated as a night light in the Contract Documents.
- C. Night lights, which are always on and also used as emergency and egress shall be connected directly to the emergency power source via the dedicated life safety emergency power circuits.
- D. In existing buildings which emergency lighting is tied to general generator powered panels, connect indicated emergency lighting to the existing panelboard already serving the emergency systems in that area.
- E. Luminaires switched by UL 924 relay control devices connected to the local switching circuit shall be labeled or provided with an indicator to indicate the use of the relay and that it is an emergency fixture. A test button or device shall be provided in an

accessible location to allow the maintenance staff to test the relay device to ensure its operation.

- F. Circuits used to power emergency egress equipment and exit signs shall be provided separately from the general lighting circuits per the NEC requirements.

PART 2 PRODUCTS

2.1 UNIT BATTERY EQUIPMENT

- A. Provide unit battery equipment that adhere to the following minimum specifications:
 - 1. 120- and 277-volt operation.
 - 2. UL 924 listed.
 - 3. 6- or 12-volt, long life, maintenance-free, nickel cadmium type batteries.
 - 4. Batteries sized to illuminate all lamps for 90 minutes.
 - 5. Low voltage battery protection to prevent deep battery discharge during extended outages.
 - 6. Brown out sensing to activate unit when line voltage drops below 80%.
 - 7. Solid state load transfer relay.
 - 8. Integral internal solid-state charger.
 - 9. Provide pilot light and test switch.
 - 10. Interior lamps/heads:
 - a. Thermoplastic heads with fully adjustable swivel, rotation, and tilt.
 - 11. Exterior lamps/heads
 - a. UL wet label listed.
 - b. Cast metal or milled housing and cast mounting brackets and boxes.
- B. Performance:
 - 1. Provide emergency lighting to illuminate the egress corridors and other required areas along the or to the path of egress. Refer to the light fixture schedule in the Contract Documents for specified types.
 - 2. Provide a minimum of 1.0 footcandle along the path of egress at the floor at 7'-6" mounting height above finished floor, unless mounting height is noted otherwise.
 - 3. If proposed fixtures do not provide this requirement with the layout provided in the Contract Documents, Contractor shall notify Engineer and provide the required quantity of fixtures to satisfy the AHJ requirements.
- C. Approved Manufacturers:
 - 1. Refer to the Light Fixture Schedule.

2.2 EXIT SIGNS

- A. Provide exit signs that adhere to the following minimum specifications:
 - 1. 120- and 277-volt operation.
 - 2. Multiple LED lamp source.
 - 3. NFPA 101 and EPA/DEP Energy Star Compliant.
 - 4. Universal mounting: right side (canopy), left side (canopy), top (canopy) and back.
 - 5. Knockouts for chevrons, right and left.
 - 6. Snap-in wiring connections to allow replacement of components without removing housing.

- B. Edge-Lit Signs:
 - 1. Single face signs shall be provided with inserts or blank back plate so that the lettering cannot be seen from behind.
- C. Battery Backup:
 - 1. Nickel cadmium batteries sized to provide 2 hours backup.
 - 2. Integral solid state battery charger.
 - 3. Low battery voltage protection
 - 4. Provide pilot light and test switch.
 - 5. AC "ON" indicator
 - 6. UL 924 listed
- D. Approved Manufacturers:
 - 1. Refer to the light fixture schedule.

2.3 EMERGENCY LIGHTING RELAY

- A. Enclosed relay circuit which shunts ON emergency lighting circuit during loss of normal power.
- B. Self-contained, rated for use in plenum space, NEMA 1 enclosure.
- C. LED indicator to indicate mode of operation and available power sources.
- D. Designed for switching circuit which the luminaire and relay is to be used with.
- E. Relay contacts rated for 20ampere, voltage to match lighting system circuit.
- F. UL 924 listed.
- G. A test button shall be mounted in an accessible location to allow the Owner to test the function of the relay. If the test button is not located adjacent to the fixture, provide a nameplate identifying its function and which luminaire(s) it operates.

PART 3 EXECUTION

3.1 EMERGENCY EGRESS LIGHTING

- A. Install a complete and operational emergency lighting system in accordance with NEC article 700 and Chapter 5 of NFPA 101 Life Safety Code.
- B. Install equipment as recommended by the Manufacturer. Notify the Engineer of any discrepancies.
- C. Support battery units directly from building structural members. Mount units to walls wherever possible.
- D. Route raceway down from ceiling to wall mounted devices. Minimize the use of exposed raceway routed through finished spaces.
- E. Connect emergency lights to the unswitched lighting branch circuit in the area served by the unit equipment.
- F. Install remote emergency lights where indicated. Provide wiring between the remote heads and the battery packs to maintain UL listing of system.

- G. Adjust emergency fixture heads for maximum effectiveness or as directed by the Engineer or AHJ.

3.2 EXIT SIGNS

- A. Provide exit signs at each exit and along the egress path.
- B. Mount exit signs to walls wherever possible. Where exit signs are shown to be installed to a lay-in ceiling, provide additional support from the building structure. Refer to Section 26 05 29: Supporting Devices for supporting requirements.
- C. Connect exit signs to an unswitched lighting circuit. Circuit can be shared with unit battery equipment.

3.3 EMERGENCY LIGHTING RELAY

- A. Provide wiring and controls for a complete operating system.
- B. Upon loss of normal power to the adjacent lighting circuit, relay shall bypass the room switching control and turn on luminaire.

END OF SECTION

SECTION 28 05 00

COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SECTION SUMMARY

- A. Work consists of furnishing labor, materials, equipment, and services required for the complete installation of work shown in the Contract Documents and as specified in Division 28.
- B. Include all parts and labor which are incidental and necessary for a complete and operable installation even though not specifically mentioned in the Contract Documents. Such items include nuts, bolts, anchors, brackets, sleeves, offsets in conduit, fittings, relays, etc.
- C. Some equipment and materials provided under Division 26 may require composite work crews because of trade jurisdiction. Where this occurs, include in the bid this portion of the composite crew labor costs. It is the Contractor's responsibility to review Division 26 Contract Documents to determine where these composite crews are required.
- D. Obtain all temporary and permanent permits and licenses required in connection with this Division's work. Pay all fees and expenses required for such permits and licenses.
- E. Request inspections as required by regulating agencies and/or regulations. Contractor shall include all charges for inspections by regulating agencies of installations of plans specifications in the Base Bid price.
- F. Include State and Local sales taxes in the bid. Keep accurate records of these taxes and furnish such records to the Owner Representative upon request.
- G. Provide the Owner Representative with a certificate of final inspection and approval by enforcement authorities.
- H. The fire alarm and detection system shall be designed and built by the Contractor.

1.2 RELATED SECTIONS

- A. Divisions 0 and 1 apply to all work of Division 28 and are an integral part of this Section. Where the conditions specified are at variance with other Divisions, Section 28 05 00 takes precedence. Section 28 05 00 specifies conditions, procedures, equipment, and material particular to the electrical work and applies to all electrical work of the Contract Documents.
- B. Division 0 and 1 and 28 05 00 and all Addenda form a part of and apply to all contracts or sub-contracts relating to Division 28 work. Copy these documents to all Sub-contractors receiving other Sections of Division 28.
- C. Where a Specification Section refers to other Sections under the Article on Related Sections, this is done for Contractor's convenience only. It shall in no way relieve the Contractor of responsibilities stated in other Sections of the Specifications, even though these Sections are not specifically referenced. The Contractor is responsible for

all information contained in this Division's Specifications as well as for information contained in all other Divisions.

1.3 REFERENCES

- A. Meet or exceed all current applicable codes, ordinances, and regulations for all installations. Promptly notify the Engineer, in writing, if the contract documents appear to conflict with governing codes and regulations. Contractor assumes all responsibility and costs for correcting non-complying work installed without notifying the Engineer.
- B. Higher quality of workmanship and materials indicated in the Contract Documents takes precedence over that allowed in referenced codes and standards.
- C. Perform all work in compliance with the currently adopted version of the following codes and standards for this project:
 - 1. National Electric Code
 - 2. State and Local Electrical Codes
 - 3. International Building Code
 - 4. International Fire Code
 - 5. International Mechanical Code
 - 6. State and Local Building Codes and Ordinances
 - 7. State Industrial Commission Regulations
 - 8. State and Local Fire Codes and Regulations
 - 9. State and Local Mechanical Codes
 - 10. State Elevator Code
 - 11. Occupational Safety and Health Administration Regulations
 - 12. Americans with Disabilities Act
 - 13. Uniform Federal Accessibility Standards
 - 14. State Board of Health
 - 15. NFPA 101 Life Safety Code
 - 16. State Energy Code
- D. Use the Standard where referenced in the specifications by the following abbreviations:
 - 1. AIA: American Insurance Association
 - 2. AIA: American Institute of Architects
 - 3. ANSI: American National Standards Institute
 - 4. ASTM: American Society of Testing and Materials
 - 5. EPA: Environmental Protection Agency
 - 6. FM: Factory Mutual Insurance Association
 - 7. IEEE: Institute of Electrical and Electronic Engineers
 - 8. IES: Illuminating Engineering Society of North America
 - 9. ICEA: International Cable Engineers Association
 - 10. NBS: National Bureau of Standards
 - 11. NEMA: National Electrical Manufacturers Association
 - 12. NFPA: National Fire Protection Association
 - 13. NSC: National Safety Council

1.4 DEFINITIONS

- A. The terms defined below apply to all work included in Division 28.
 - 1. 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.
 - 2. Furnish – to obtain in new condition ready for installation into the work.
 - 3. Install – to store, set in place, connect and place into operation into the work.
 - 4. Provide – to furnish and install.
 - 5. Connect – to bring service to the equipment and make final attachment including necessary switches, outlets, boxes, terminations, etc.
 - 6. Conduit – includes in addition to conduit, all fittings, pull boxes, hangers and other supports and accessories related to such conduit.
 - 7. Concealed – hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
 - 8. Exposed: not installed underground nor concealed as defined above.
 - 9. Building structure or building structural members - consists of steel columns, steel beams, steel joists (top chord and at panel points), concrete walls and concrete block walls. Metal decking, joist bridging and bottom chords of bar joists shall not be construed as building structure nor as a building structural member for the purpose of support.
- B. The drawing and specifications constitute the Contract Documents. Any item noted in the specification or shown on the drawings is included in the Contract Documents.
- C. All electrical details and drawings are diagrammatic, unless specifically noted. Field verify all dimensions and notify the Engineer of any conflicts of discrepancies, in writing, prior to installation.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Initiate, maintain and supervise all safety precautions required with this work in accordance with the regulations of the Occupational Safety and Health Administration (OSHA) and other governing agencies.
- B. Environmental Requirements:
 - 1. Do not remove or disturb any asbestos containing materials from the project. Immediately stop work and notify the Owner Representative if asbestos containing materials are suspected.
 - 2. Do not dispose of any PCB containing materials. Disposal of all PCB containing materials will be the responsibility of the Owner Representative.
- C. Provide new, first quality material for all products specified. Do not reuse materials unless indicated or approved by the Engineer.

- D. Comply with the NEC as applicable to the construction and installation of equipment specified in this section.
- E. Provide equipment specified in this section that has been listed and labeled by a nationally recognized testing laboratory.
- F. Comply with ANSI as applicable to equipment specified in this section.
- G. Comply with NEMA as applicable to equipment specified in this section.

1.6 PROJECT/SITE CONDITIONS

A. Site Inspections:

1. Before submitting a proposal on the work contemplated, examine the site of the proposed work and become thoroughly familiar with existing conditions and limitations. No extra compensation will be allowed because of misunderstanding as to the amount of work involved nor bidders lack of knowledge of existing conditions which could have been discovered or reasonably anticipated prior to bidding.
2. Conduits, pipes, ducts, lights, devices, speakers, etc., shown on the drawings as existing have been based on existing plans and may not be installed as originally shown. It is the Contractor's responsibility to visit the site and make exact determination of the existence, location and condition of such facilities prior to submitting a bid.

B. Correlation of Work:

1. Consult the drawings and specifications of all other Divisions for correlating information and layout work so that it will coordinate with other trades. Verify dimensions and conditions (i.e., finished ceiling heights, footing and foundation elevations, beam depths, etc.) with the Architectural and Structural drawings. Notify the Architect/Engineer of any conflicts that cannot be resolved, in the field, by affected trades. Replacement of work due to lack of coordination and failure to verify existing conditions will be completed at no cost to the Owner Representative.
2. Install all conduit, cable tray, equipment, etc. allowing proper code and maintenance clearances and avoiding blocking passageways and access panels.
3. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no cost to the Owner Representative. This applies to shop fabricated work as well as to work fabricated in place.
4. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall adjust without additional cost to the Owner Representative, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.
5. Equipment outlines shown on detail plans of 1/4"=1'-0" scale or larger and/or dimensions indicated on the plans are limiting dimensions. Do not install any equipment that exceeds the equipment outlines shown or reduces indicated clearances.

6. Obtain exact location of connection to equipment, furnished by others, from the person furnishing the equipment.
7. Drawings and specifications are complementary and what is called for in either one is as binding as if called for in both.
8. Include the better quality, greater quantity or higher cost for an item or arrangement where a disagreement exists in the drawings and specifications.

1.7 SEQUENCING AND SCHEDULING

- A. Refer to General Conditions and Requirements.

1.8 EQUIPMENT INSTRUCTIONS AND PARTS LITERATURE

- A. Instruction and parts literature are generally packed with electrical equipment and devices. Contractor shall remove this literature from the packing container or equipment enclosure, identify the literature with the equipment to which it applies, and file the literature in loose-leaf binders with index tabs. Each binder shall have an index which lists each piece of equipment and the literature which applies to it. An index tab shall be provided for each piece of equipment.
- B. Contractor shall establish a procedure with the other trades for receiving, identifying, and filing literature for devices which are removed from their packaging and installed by other trades.

1.9 SUBMITTALS

- A. Submit the following items consistent with Division 0 and Division 1. Refer to each Section under Division 26 for additional submittal requirements particular to that Section.
- B. Prior Approvals:
 1. Submit approval form for each request for prior approval.
 2. Submit hard copy, bound, written requests to use unspecified items, to the Engineer, no later than ten (10) calendar days prior to the bid opening. Submit detailed information for proposed material or equipment specific to the project, clearly indicating all options included in the submittal.
 3. Accepted substitutions will be incorporated in an Addendum to the Contract Documents.
 4. Contractor is responsible for dimensional differences, electrical requirements, and any other resulting changes, when using accepted substitutions. Contractor is responsible for any additional costs incurred because of substitutions, including other contractors and Architect/Engineer fees.
 5. Material and equipment not specified or accepted in an Addendum will be removed and replaced at no cost or inconvenience to the Owner Representative.
- C. Work Scope Change:
 1. If a work scope change is requested and Contractor would like to be awarded additional compensation or a deduction from original contract is requested, Contractor shall provide a schedule of values for all associated proposed work.

- a. Schedule of values shall include all proposed material, labor, and other associated costs. Provide a final lump sum number for all work associated with the change and individual pricing for each item on the schedule of values.
 - b. Engineer may request additional breakdown for improved clarity and Contractor must comply prior approval for the additional compensation or credit.
 2. Contractor shall provide actual manufacturer and distributor invoices showing cost of work affected by the work scope change upon request of Engineer and/or Owner Representative.
 3. Contractor is solely responsible for delays in schedule where Contractor is required to resubmit documentation, revise requested documentation or provide additional information associated to gaining approval for the work scope change.
- D. Shop Drawings and Manufacturer's Information:
1. Submit in accordance with the Division 0 and Division 1. Unless noted otherwise, submit drawings to the Engineer for review within 30 calendar days after award of Contract.
 2. Provide separately bound documents for each submittal for each section. Combination submittals will be returned to the Contractor without review and count as 1 submittal. Do not combine submittals from multiple sections.
 3. Include project name, name of Architect, name of Engineer, contractor, sub-contractor, manufacturer, supplier and sales representative, include name, address, and phone number for the sales representative. Clearly identify section number and description of equipment submitted. Shop drawings not including all of this information will be returned without review, and count as 1 submittal.
 4. Examine all shop drawings noting capacity, arrangement, and physical dimensions. Clearly mark all relevant items on catalog data and cross-out unrelated information.
 5. Submittals for equipment provided by the Electrical Contractor shall bear a stamp or specific written certification from the Electrical Contractor, certifying the submittals have been reviewed and approved by the submitting Electrical Contractor.
 6. Provide the following shop drawing and manufacturer information:
 - a. Product Data Sheets:
 - 1) Describe all equipment and devices to be provided.
 - 2) Include all features specified.
 - 3) Provide dimensioned prints with weights.
 - 4) Highlight or otherwise accentuate on each data sheet the specified product features and product numbers.
 - 5) Features or part numbers which do not apply shall be struck through, crossed out, blacked out, or otherwise identified as not applicable.
 - b. Composite Drawing:
 - 1) Power and control wiring for all systems and equipment.
 - 2) Show basic systems on composite drawing.
 - 3) Use terminal numbers on drawings and schematics.
 - 4) Use separate drawings to show details of sub-systems.

- 5) Identify sub-system drawing interface points on composite drawing and sub-system drawings; terminal numbers of interface points shall be the same on both drawings.
 - 6) Revise or redraw manufacturer's standard drawings to meet above requirements.
 - c. Record all Changes to Existing Systems:
 - 1) Revise all wiring diagrams and schematic diagrams to show final installation:
 - a) Includes all new and existing equipment diagrams.
 - d. Programmable Systems:
 - 1) Description of programmable system operation, including but not limited to input/output functions, control capabilities, configuration procedures, starting setpoints, etc.
 - 2) Preliminary graphic screens and reports.
 - a) This submittal shall occur prior to shipment of the system.
 - e. Manufacturers Installation Instructions:
 - 1) Include with shipment.
 7. If the Engineer rejects (Make corrections noted/Submit corrected copy, Rejected/Submit specified item) two (2) times for material under the same section the Engineer will be compensated for the additional reviews. Compensation will be incorporated by Change Order and deducted from the Contractor's application for payment. Contractor is solely responsible for any project delays caused by having to resubmit submittals.
- E. Operating and Maintenance Manuals:
1. Include all the information provided with the approved shop drawings and manufacturer's information.
 - a. Update and complete control system drawings and descriptions for all equipment.
 - b. All documentation shall include modifications made which reflect the final installation.
 - c. All completed testing reports.
 2. Date the manuals with the day, month, and year they are provided to the Owner Representative/Engineer.
 3. Provide manufacturers' user manuals and installation instructions.
 4. Provide 3 hard (paper) copies in a 3-ring binder. Provide a table of contents and each piece of equipment or sub-system shall be tabbed.
 5. Provide 2 digital copies in a PDF format saved to a compact disk or USB drive. The saved files shall be clearly identified and organized in a similar manner to the hard copies
 - a. Data saved on the disks shall be accessible and neatly organized.
 - b. Provide a table of contents which utilizes bookmarks and links. The links shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A link shall be provided for materials associated with each piece of equipment included in the O&M manual.
 6. Record all Changes to Existing Systems

7. Insert revised documents into the Owner Representative's existing operation and maintenance manuals in place of original documents, if such O&Ms exist.
- F. Record Documents:
1. Provide three sets of paper copies of record documents and two digital pdf copies. Record Drawings shall be of the same size as the original published contract drawings.
 2. Provided with the O&M's.
 3. Record drawings shall include all work scope changes, including addenda.
 4. Record drawings shall show locations of all above ceiling control devices, such as relays, contacts, control modules, monitor modules, fire/smoke detection equipment, etc.
 5. Refer to Division 0 and Division 1 for additional Record Drawing requirements.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION

- A. Continuity of existing systems:
1. No Division 28 systems are to remain inactive at the end of the workday. Assure that the systems are all operational at the end of each workday. Coordinate temporary outages with the Owner Representative.
 2. Coordinate/schedule all work with the Owner Representative to minimize any disruptions. Confine all interruptions to the smallest possible area. Provide temporary connections if required to provide continuity of service.
 3. Inspect all areas affected by the interruptions and return all automatically controlled equipment, electrically operated equipment to the same operating condition prior to the interruption.
- B. Use of Facility:
1. Do not disturb normal use of the facility, except within the immediate construction area. Keep walks, driveways, entrances, etc. free and clear of equipment, material and debris.
 2. Store all equipment and material in a place and manner that minimizes congestion and is approved by the Owner Representative.

3.2 INSTALLATION

- A. Material and Workmanship
1. Provide new material and equipment, unless noted otherwise. Protect equipment and material from damage, dirt and the weather.
 2. Provide the highest quality workmanship and perform all work only by skilled mechanics. Install material and equipment in accordance with manufacturers' recommendations, instructions and current NECA standards.
 3. The Engineer reserves the right to reject material or workmanship not in accordance with the specifications, before or after installation.

- B. Cutting and Patching:
1. Perform all cutting and patching necessary to work, unless specifically delegated to be performed by a different Division.
 2. Obtain special permission from the Engineer before cutting structural members or finished material.
 3. Perform all patching in a manner as to leave no visible trace and return the area affected to the condition of undisturbed work. Perform all patching by workers experienced, skilled, and licensed for the work involved. Inferior work will not be accepted.
 4. Patch all holes left because of demolition of electrical equipment and devices.
 5. Drill all holes in masonry with rotary drill. Impact tools are not allowed. Core drill all holes in masonry and concrete for electrical raceway. Provide and dispose of all water required for core drilling. Coordinate with other trades to prevent damage from water.
 6. Prevent the spread of dust, debris, and other material into adjacent areas.
 7. Replace all ceiling tiles damaged during installation of work with new tile.
- C. Painting:
1. Refinish all fire alarm equipment damaged during shipping and/or installation to its original condition. Remove all rust; prime, and paint per manufacturer's recommendations for finish equal to original.

3.3 EXISTING CONSTRUCTION

- A. All modifications to the fire alarm systems shall be staged to limit the frequency and duration of alarm system impairments. Systems shall always be operable.
- B. The Contractor shall notify the Owner Representative in writing at least two working days in advance of any impairment. The maximum planned impairment duration shall be 8 hours.
- C. No more than one smoke compartment of a building will be allowed to be impaired at one time. For buildings which are not separated into smoke compartments no more than one floor of the building will be allowed to be impaired at one time.
1. The impaired area of the building shall not be left unattended by the Contractor's personnel during an impaired state. Contractor shall provide fire watch personnel during an impairment period.
 2. If unavoidable or in the event of an unplanned incident, the Contractor shall notify the Owner Representative's Representative of any impairment lasting more than 8 hours.

3.4 FIELD QUALITY CONTROL

- A. Final Inspection:
1. A final inspection of the electrical systems will be required before the Contract can be closed out. Request a final inspection by the Engineer after all systems are fully completed and operational. The Engineer will schedule an inspection and generate a list of items to be corrected or completed before Contract Closeout. If the Engineer is requested to make a final inspection by the Contractor, and the Engineer finds the work is not complete enough to perform that inspection, the

Contractor will compensate the Engineer for his time. The Contractor will then perform the necessary work to complete the project and again request a Final Inspection.

3.5 CLEAN UP

- A. Keep the premises free from accumulation of waste material or rubbish, caused by his employees or work, always. Remove rubbish, tools, scaffolding, and surplus materials from and about the building, and leave work areas "broom clean" or its equivalent upon completion of the work. Clean electrical equipment and remove temporary identification. In case of dispute the Owner Representative will remove the rubbish and charge the cost to the Contractor.
- B. After tests have been completed and accepted, clean light fixtures, panels and other equipment installed by the Contractor, leaving the entire work area in a clean and complete working order.

3.6 PROTECTION

- A. Cover openings and equipment, where set, to prevent obstruction to racways, breakage, misuse, or disfigurement of equipment. Cover openings in equipment immediately upon uncrating or receipt at the job site and keep covered until permanent connection is made.
- B. Contractor is responsible for any damage to electrical equipment or materials until final acceptance of the entire project by the Owner Representative. Keep all equipment and materials clean until final acceptance of the entire project by the Owner Representative.
- C. If a portion of the project is to be occupied by the Owner Representative prior to Substantial Completion of the entire project plan with the Owner Representative to transfer responsibilities for protection and housekeeping.

3.7 ELECTRIC FIRE AND SMOKE DAMPERS

- A. Division 26 Contractor shall provide power to all smoke, fire, smoke/fire dampers which are rated for 120V AC or greater.
- B. Wiring for fire alarm and other life safety monitoring and alarm shall be provided under Division 28.
- C. Contractor is responsible for coordinating locations and requirements of the electric dampers with the equipment provider and the Mechanical Contract Documents. Not all dampers may be indicated in the Electrical Contract Documents.

END OF SECTION

SECTION 28 05 15

TESTING OF FIRE ALARM SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Testing Fire Alarm Systems.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Miscellaneous testing equipment as detailed.

PART 3 EXECUTION

3.1 FIRE ALARM SYSTEM TESTING

- A. Inspect the fire alarm system with the manufacturer's representative of the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal detectors, smoke detectors, flow switches, and controls, whether or not manufactured by the manufacturer. The inspection to comprise examination and certification of such equipment for the following:
 - 1. The system functions properly.
 - 2. The type of equipment installed is designated by the Engineer's specifications.
 - 3. The wiring connections to all equipment components have been installed in accordance with UL requirements.
 - 4. Equipment of the manufacturer has been installed in accordance with the manufacturer's recommendation and that all signaling devices of whatever manufacturer have been operated or tested to verify their operation: The supervisory wiring of those items of equipment connected to a supervised circuit is operating and that the regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials.
- B. Inspection Certification: Upon completion of the inspection and when all the above conditions have been complied with, the manufacturer is to issue to the Engineer:
 - 1. A copy of the inspecting technician's report showing location of each device and certifying the test results of each device.
 - 2. A certificate of verification confirming that the inspection has been completed and accepted by the authority having jurisdiction and showing the conditions upon which such inspection and certification have been rendered.
- C. Owners Instruction: The manufacturer provides the services of a competent alarm system technician for the period of two working days, at a time convenient to the Owner, to instruct the staff in the operation and maintenance of the system.
- D. Provide a letter to the Owner and Fire Marshal certifying that the installed system is UL certified.

END OF SECTION

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SECTION 28 31 00
FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Fire Alarm System
- B. Interface to HVAC Systems
- C. Interface to Automatic Closing and Self-Closing devices
- D. Interface to Fire Protection System
- E. Interface to Owner Telephone system

1.2 RELATED SECTIONS

- A. Section 26 05 00: Common Work Results for Electrical
- B. Section 26 05 26: Grounding and Bonding for Electrical Systems
- C. Section 26 05 29: Supporting Devices
- D. Section 26 05 33: Raceways, Fittings, and Boxes
- E. Section 28 05 00: Common Work Results for Electronic Safety and Security
- F. Section 28 05 15: Testing of Fire Alarm Systems

1.3 SYSTEM DESCRIPTION

- A. The fire alarm and detection system shall be designed and provided by the Contractor. The Contractor designed system shall fulfill all applicable codes, standards and authorities having jurisdiction. The scope of this system is indicated to some extent, but not a fully complete design, in the Contract Documents. The project intent is for Contractor to provide a system that meets Owner/User expectations and all extents of applicable codes.
- B. Contractor shall provide with respect to his design: Certifications, signatures, stamps, seals, etc. by persons, such as technicians, engineers, etc., meeting all qualifications required by codes and authorities having jurisdiction.
- C. Provide a complete operational fire alarm system including the following components: Existing main control panel, remote annunciators with alarm silence and reset capability; remote detectors; interfaces to HVAC fans, combination smoke/fire dampers and sprinkler systems; audible and visual indicating devices; monitor and control modules; communication devices; raceway system, boxes, wiring, grounding and the associated labor, programming, setup, and testing.
- D. Where materials, equipment or system descriptions appear in the Contract Documents which may violate an applicable code, Contractor shall notify Engineer before installing such items

- E. Provide a two-wire Class B, low voltage, power limited, ADA compliant, addressable, closed circuit, electrically supervised, non-coded, temporal sounding type system as described in NFPA 72.
- F. Provide individual alarm and trouble indication for each initiating device.
- G. Provide a clear distinction (at the main control panel and remote annunciators) between the alarm notification signal and the trouble notification signal.
- H. Provide automatic HVAC system shut down for air handling units that move an air volume more than 2000 cfm. Provide duct detectors in the return ducts, and addressable control modules at each motor starter.
- I. Provide remote annunciators where shown on Drawings. Verify exact location of remote annunciators with the Owner.
- J. Provide power and control wiring to automatic closing and self-closing devices (door holders, fire shutters, smoke dampers, etc.), relays, HVAC unit starters, and any other interfaces to equipment required to be interfaced to the fire alarm system.
- K. All smoke detectors in sleeping rooms/guest rooms shall have a sounder base which produces a 520 Hz low frequency audible fire alarm signal per NFPA 90 18.4.5.3.

1.4 SYSTEM PERFORMANCE

- A. The provided fire alarm and detection system shall be compatible and operate with the control system panel.
- B. The system shall be complete in every detail, whether such detail is specifically shown or not.
- C. Provide all materials, products, wiring, labor, equipment, programming, services, etc. required for a fully complete and operational system.
- D. Contractor shall provide all interlocks, interfaces, etc. as necessary to integrate his system with other systems.
- E. Contractor shall pay all fees, and any other costs associated with the system.
- F. Contractor shall provide all associated products and services including but not limited to:
 - 1. Written two-year warranty which begins at substantial completion.
 - 2. Operation and maintenance manual including all information necessary to operate and maintain system.
 - 3. Programming and setup.
 - 4. Start-up, troubleshooting and debug.
 - 5. Instruction Owner.
 - 6. Demonstrating system to Owner, Inspector, etc.
 - 7. As built drawings in every detail. Update existing drawings to reflect the modifications made.
 - 8. Parts list.
 - 9. Testing in accordance with all applicable standards and to the satisfaction of the authorities having jurisdiction.

1.5 OPERATION

- A. It is the responsibility of the Contractor to visit the site and record all pertinent data and information of the existing system and facility which would affect the bid price before the bid is submitted.
- B. Programming of the Control panel shall be like the existing controls for the affected area and remaining facility areas. Where governing code requires programming and features to be revised, Contractor shall modify the controls to meet such requirements.
- C. Provide the following sequence of events after the main control panel has determined that an alarm condition exists within the building, and the alarm has been verified:
 - 1. Sound the alarm notification signal at the main control panel and all remote annunciators.
 - 2. Display in plain English the description of the location of the device in alarm at the main control panel and each remote annunciator.
 - 3. Activate all audible and visual indicating devices in the associated indicating zone within the building. Activate all audible alarm indicating devices in a synchronous temporal pattern and all visual indicating devices in a one (1) hertz synchronous flash pattern until silenced by the alarm silence switch at the control panel or remote annunciator.
 - 4. Close the domestic water shutoff solenoids at the sprinkler service(s) if water flow is detected by any sprinkler flow switch.
 - 5. Release all self-closing and automatically closing devices powered by the fire alarm system within the building.
 - 6. Shut off any monitored HVAC system if smoke is detected by the associated HVAC unit duct detector.
 - 7. Initiate the communication/modem device to transmit the point-specific information to the off-site monitoring station.
 - 8. Store the event in the history log.
- D. Provide the following sequence of events after the main control panel has determined that a trouble condition exists within the building:
 - 1. Sound the trouble notification signal in the main control panel and all remote annunciators.
 - 2. Display in plain English the description of the location of the device in trouble at the main control panel and each remote annunciator.
 - 3. Store the event in the history log.
- E. Provide the following sequence of events after the main control panel determined that a supervisory condition exists within the building:
 - 1. Sound the trouble notification signal in the main control panel and all remote annunciators.
 - 2. Display in plain English the description of the location of the supervisory signal at the main control panel and each remote annunciator.
 - 3. Store the event in the history log.

- F. The following system conditions shall not initiate the communicator to transmit the alarm information to the remote monitoring location:
 - 1. Smoke duct detectors required HVAC unit shutdown.
 - 2. Detectors require the automatic release of fire doors.
 - 3. Detectors required for the automatic release of combination fire/smoke dampers.
 - 4. Detectors located within each dwelling unit.
 - 5. Detectors for elevator recall.
 - 6. Detectors for elevator power shutoff.
 - 7. Detectors for kitchen equipment power shutoff.
- G. Automatic detectors at the following locations shall initiate a trouble signal, not a general alarm:
 - 1. Smoke duct detectors for HVAC unit shutdown.
 - 2. Detectors required for the automatic closure of fire doors and fire shutters.
 - 3. Detectors required for the automatic closure of fire/smoke dampers.
 - 4. Detectors located in elevator lobbies and machine rooms required for the recall of elevators.
- H. Provide green LED and the word NORMAL on the LCD display if the system is in its normal operating mode, and no alarms or faults exist in the system.

1.6 SUBMITTALS

- A. Submit qualifications of the system installer as specified in this section.
- B. Submit a complete shop drawing package of the proposed system.
- C. Provide clearly legible shop drawings.
- D. Submit shop drawings in a neatly bound comb or three ring binder with protective covers. Indicate on the front cover the date submitted, project name, specification section number, electrical contractor's name, address, telephone number and the submitting equipment supplier's address and telephone number. Allow enough clear area on the title sheet for shop drawing review stamps.
- E. Submit 1/8" scale reproducible floor plans showing all rooms, stairways, corridors, horizontal exits, controlled HVAC units, sprinkler flow and control valves, and all fire alarm system components. The drawings shall include exact wire counts and types, and point address information for each device. Single line for walls may be used.
- F. Submit the following riser/wiring/connection diagrams:
 - 1. Single line riser drawing indicating all system components and the vertical wiring necessary to connect the components. Indicate conduit sizes and wire counts and a legend indicating the type of wiring.
 - 2. Functional block diagram showing initiating device wiring, loop communications wiring, annunciator wiring, power supply wiring, indicating device wiring, power supply wiring, battery wiring, communications/modem wiring, etc. It is not necessary to show every initiating and indicating device on the riser diagram but illustrate the wiring and connection of each type of device on each addressable loop. Indicate on the diagram the quantity of devices on each loop and the

- maximum allowable quantity of devices on each loop (to determine the number of spare addresses for future expansion).
3. Wiring diagrams showing wiring and terminations between HVAC fan units and the fire alarm system.
 4. Wiring diagrams showing wiring and terminations between combination fire/smoke dampers and the fire alarm system.
 5. Wiring diagrams showing wiring and terminations between self-closing and automatically closing devices and the fire alarm system.
 6. Wiring diagrams showing wiring and terminations between sprinkler system flow switches, valve position switches, dry pipe low pressure monitoring switches, etc., and the fire alarm system.
 7. Branch circuit wiring to the main control panel, sub-panels, and other devices in the system requiring 120-volt power.
- G. Submit original drawings produced by the supplier/manufacturer. Submitting reproductions of the Contract Documents is not acceptable.
- H. Submit a material list showing quantity, manufacturer, type and description of each item being furnished. Indicate in a separate list, the quantity and description of all spare parts to be turned over to the Owner at the end of the project.
- I. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.
- J. Submit physical and schematic drawings of special and custom components or hardware.
- K. Submit power supply sizing and battery sizing calculations showing total fire alarm system power draw in the supervisory and alarm conditions.
- L. Submit complete description of system operating sequence.
- M. Equipment mounting details and instructions are to be provided to Contractor before installation of equipment.
- N. Submit complete description of system operating sequence.
- O. Shop drawings not containing all the information listed above will be rejected without review.
- P. Engineer review of shop drawings does not vacate responsibility of contractor to provide a functioning system meeting the Owner/User expectations and all extents of applicable codes.

1.7 QUALITY ASSURANCE

- A. Only manufacturers that provide complete engineering, technical and support services to properly complete the project as designed are allowed.
- B. Provide the following, prepared by the manufacturer and supplier:

1. Certification of project and drawings.
 2. Project management as required by Engineer and Owner.
 3. Complete project testing and training to Engineers and Owners satisfaction.
 4. Underwriters Laboratories (U.L.) Certification.
 5. Service personnel to be NICET Level II Certified.
 6. Maintained inventory levels to provide service parts as required by the specification.
- C. Provide fire alarm and detection systems conforming to the requirements of the latest edition of the following National Fire Protection Association (NFPA) publications including all amendments to these publications:
1. 13: Standard for the Installation of Sprinkler Systems.
 2. 70: National Electrical Code, including Article 760.
 3. 71: Protective Signaling Systems.
 4. 72: National Fire Alarm Code.
 5. 101: Life Safety Code.
- D. Construct and install all fire alarm and fire detection equipment in accordance with the following publications:
1. Underwriters Laboratories Inc. (UL):
 - a. 38 Manually Activated Signaling Boxes for Use with Fire Protection Signaling Systems.
 - b. 268 and 268A Smoke Detectors for Fire Protective Signaling Systems.
 - c. 346 Waterflow Indicators for Fire Protective Signaling Systems.
 - d. 464 Audible Signal Appliances.
 - e. 864 Control Units for Fire Protective Signaling Systems.
 - f. 1481 Power Supplies for Fire Protective Signaling Systems.
 - g. 1971 Visual Signaling Appliances for the Hearing Impaired.
 2. Americans with Disabilities Act.
 3. International Fire Code (IFC).
 4. International Mechanical Code (IMC).
 5. International Building Code (IBC).
 6. State Building Code
 7. Minnesota Amendments to the IBC, IMC, and IFC.
 8. Local (City) Codes
- E. Provide components that are listed and cross listed as a product of a single fire alarm system manufacturer by Underwriter's Laboratory, Inc. (U.L.) and bear the "U.L." label. Provide control equipment listed under U.L. category UOJZ as a single control unit.
- F. Qualifications of the Installer:
1. Before commencing work, submit data showing that the contractor/subcontractor has successfully installed fire alarm systems of the same type and design as specified. Include the names, locations, and the contact's name and telephone number of at least six (6) such installations completed by the installer. Specify type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding eighteen (18) months.

2. Provide evidence of completion of the required manufacturers' training and experience by the contractor or have NICET Level II (or higher), Certified Fire Alarm or Special Hazard Associate Engineering Technician(s), as applicable, in their employment.
 3. Experience of Installer: Accomplish installation by a Contractor with a minimum of five years' experience in the installation of the specified fire alarm system. Any proposed installer who cannot show evidence of such qualifications will be rejected.
- G. Manufacturer's Representative
1. Provide the services of a representative or technician licensed in the State of Minnesota from the manufacturer of the system, or a factory trained technician of the manufacturer of the system, experienced in the installation and operation of the type of system provided. Supervise installation, software documentation, adjustment, preliminary testing, final testing, and certification of the system. Provide the required instruction to the Owner's personnel in the system operation, maintenance, and programming.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Equipment supplied by manufacturers as listed herein are considered approved for bidding on this project. Where specific models are referred to, the intent is to establish a minimum level of features and performance.
- B. Contractor shall field verify existing system make and model. Contractor shall provide manufacturer as required to maintain a UL rating and to meet the requirements of governing codes. Where existing manufacturer may not be required to be matched, systems manufactured by the following are approved for bidding purposes on this project. Approval for installation is subject to review and approval of shop drawings.
1. Siemens

2.2 INTELLIGENT AUTOMATIC PHOTOELECTRONIC SMOKE DETECTORS

- A. Provide automatic photoelectronic smoke sensors with the following specifications:
1. Utilizes light scattering principle from an internal infrared LED light source and reports the percent obscuration to the main control panel.
 2. Factory set threshold at a nominal 1.5% light obscuration per foot (set via the main control panel)
 3. Operates +14-to-+120-degree F temperature, 10% to 93% humidity range.
 4. Operates on single twisted pair cable.
 5. Self-compensating drift compensation for maximum stability (set via the main control panel).
 6. Integral red LED visible from below the detector to indicate an alarm condition and to indicate the polling pulse from the main control panel.
 7. Mounts to base by twist locking motion.
 8. Listed U.L. 268 7th Edition.
- B. Provide detector base with addressable communications module.

- C. Provide unique address assignment for each detector, either through DIP switches located in the communication module or assigned by the main control panel.

2.3 INTELLIGENT AUTOMATIC HEAT DETECTORS

- A. Provide automatic heat detectors with the following specifications:
 - 1. Utilizes a combination of fixed temperature and rate of rise compensation (temperature exceeds 15 degree per minute rise, set via the main control panel).
 - 2. Operates at +14-to-+122-degree F temperature, with relative humidity less than 93%.
 - 3. Integral red LED visible from below the detector to indicate an alarm condition and to indicate the polling pulse from the main control panel.
 - 4. Mounts to base by twist locking motion.
 - 5. U.L. 521 listed.
- B. Provide detector base with addressable communications module.
- C. Provide ordinary rated (135-degree F) detectors in normal spaces. Provide intermediate rated (175-degree F) in unconditioned spaces such as boiler rooms or other areas with a high ambient temperature.
- D. Provide unique address assignment for each detector, either through DIP switches located in the communication module or assigned by the main control panel.

2.4 INTELLIGENT PHOTOELECTRONIC DUCT SMOKE DETECTORS

- A. Provide automatic photoelectronic duct smoke sensors with the following specifications:
 - 1. Utilizes light scattering principle from an internal infrared LED light source and reports the percent obscuration to the main control panel.
 - 2. Factory set threshold at a nominal 1.5% light obscuration per foot (set via main control panel)
 - 3. Self-compensating drift compensation for maximum stability (set via main control panel).
 - 4. Operates at air velocities from 300-4000 ft/min, +32-to-+120-degree F operating temperature, 10%-93% humidity range.
 - 5. Operates on single twisted pair cable.
 - 6. Smoke chamber blocks particles larger than 200 microns.
 - 7. Integral red LED visible from outside the detector housing to indicate an alarm condition and to indicate the polling pulse from the main control panel.
 - 8. Mounts to housing/base by twist locking motion.
 - 9. U.L. 268 listed.
- B. Provide detector base with addressable communications module.
- C. Provide unique address assignment for each detector, either through DIP switches located in the communication module or assigned by the main control panel.
- D. Provide HVAC duct-mounted housing and sampling tubes of the proper length to sample the entire width of the HVAC duct. Provide additional duct smoke detectors as

required for ducts wider than the longest sampling tube recommended by the fire alarm manufacturer.

- E. Provide addressable control module and associated relay rated at 10 amps for connection to HVAC unit starter circuit for fan motor shutdown. Provide unique address assignment for each control module, either through DIP switches located in the control module or assigned by the main control panel.
- F. Provide addressable control module and associated relay for connection to combination smoke/fire dampers. Provide unique address assignment for each control module, either through DIP switches located in the control module or assigned by the main control panel.
- G. Provide remote test station for each duct detector in a readily accessible location near the unit. Provide engraved label on remote test station denoting the location, HVAC unit number, "RETURN", damper location, etc. as required to identify the detector's location and function.

2.5 BEAM SMOKE DETECTORS

- A. Provide beam smoke detector with the following specifications:
 - 1. Utilizes percent obscuration from a light source in the transmitter reported at the receiver to determine alarm and trouble.
 - 2. Self-compensating drift compensation for maximum stability.
 - 3. Operates at +32-to-+130-degree F operating temperature and up 95% humidity range (noncondensing).
 - 4. Operates on a 4-wire cable between the transmitter and receiver pair, and one twisted pair cable between the communications module and the main control panel.
 - 5. Integral LEDs visible from outside the detector housing to indicate an alarm or trouble condition, and to indicate the polling pulse from the main control panel.
 - 6. Mounts to wall or ceiling.
 - 7. U.L. listed.
- B. Provide addressable communications module with each transmitter/receiver pair to communicate alarm and trouble signals to the main control panel.
- C. Provide unique address assignment for each beam detector transmitter/receiver pair, either through DIP switches located in the communication module or assigned by the main control panel.

2.6 AUTOMATIC-CLOSING AND SELF-CLOSING DEVICES

- A. Includes magnetic door holders, automatic doors and rolling fire shutters (provided by others)
- B. Provide magnetic door holder with the following specifications:
 - 1. Minimum holding force of 25 lbs.
 - 2. Surface, wall mounted.
 - 3. Operates at 24 VDC from the fire alarm panel.
 - 4. U.L. listed.

- C. Provide interface wiring between each closing device and the fire alarm system.
- D. Provide power to 24 VDC and 120 VAC closing devices.
- E. Provide addressable control module at each closing device to allow the main control panel to actuate each closing device independently.
- F. Provide unique address assignment for each self-closing device, either through DIP switches located in the control module or assigned by the main control panel.
- G. Provide addressable control module wiring between each closing device and the fire alarm system to allow the main control panel (through software) to operate the devices in either of two ways:
 - 1. Any alarm in the building closes all automatic closing and self-closing devices.
 - 2. Only the detectors adjacent to the automatic closing and self-closing devices close the devices.

2.7 SYSTEM COMPONENTS – ADDRESSIBLE DEVICES:

- A. Addressable Devices – General
 - 1. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
 - 2. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
 - 3. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
 - 4. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
 - 5. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
 - 6. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set

in the FACP program and allowing the system operator to view the current analog value of each detector.

7. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
8. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
9. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.
10. Addressable modules shall operate on single twisted pair cable, unless noted otherwise.

B. Intelligent Automatic Photoelectronic Smoke Detectors

1. Provide automatic photoelectronic smoke sensors with the following specifications:
 - a. Utilizes light scattering principle from an internal infrared LED light source and reports the percent obscuration to the main control panel.
 - b. Factory set threshold at a nominal 1.5% light obscuration per foot (set via the main control panel)
 - c. Operates +14 to +120 degree F temperature, 10% to 93% humidity range.
 - d. Self-compensating drift compensation for maximum stability (set via the main control panel).
 - e. Listed U.L. 268 7th Edition.
2. Provide manual station with addressable communications module.
3. Provide unique address assignment for each detector assigned by the main control panel.

C. Intelligent Automatic Heat Detectors

1. Provide automatic heat detectors with the following specifications:
 - a. Utilizes a combination of fixed temperature and rate of rise compensation (temperature exceeds 15 degree per minute rise, set via the main control panel).
 - b. Operates at +14 to +122 degree F temperature, with relative humidity less than 93%.
 - c. U.L. 521 listed.
2. Provide manual station with addressable communications module.
3. Provide unique address assignment for each detector assigned by the main control panel.
4. Provide ordinary rated (135 degree F) detectors in normal spaces. Provide intermediate rated (175 degree F) in unconditioned spaces such as boiler rooms or other areas with a high ambient temperature.

D. Intelligent Photoelectronic Duct Smoke Detectors

1. Provide automatic photoelectronic duct smoke sensors with the following specifications:
 - a. Utilizes light scattering principle from an internal infrared LED light source and reports the percent obscuration to the main control panel.

- b. Factory set threshold at a nominal 1.5% light obscuration per foot (set via main control panel)
 - c. Self-compensating drift compensation for maximum stability (set via main control panel).
 - d. Operates at air velocities from 300-4000 ft/min, +32 to +120 degree F operating temperature, 10%-93% humidity range.
 - e. Smoke chamber blocks particles larger than 200 microns.
 - f. U.L. 268 listed.
 - 2. Provide detector base with addressable communications module.
 - 3. Provide unique address assignment for each detector assigned by the main control panel.
 - 4. Provide HVAC duct-mounted housing and sampling tubes of the proper length to sample the entire width of the HVAC duct. Provide additional duct smoke detectors as required for ducts wider than the longest sampling tube recommended by the fire alarm manufacturer.
 - 5. Provide addressable control module and associated relay rated at 10 amps for connection to HVAC unit starter circuit for fan motor shutdown. Provide unique address assignment for each control module assigned by the main control panel.
 - 6. Provide addressable control module and associated relay for connection to combination smoke/fire dampers. Provide unique address assignment for each control module, either through DIP switches located in the control module or assigned by the main control panel.
 - 7. Provide remote test station for each duct detector in a readily accessible location near the unit. Provide engraved label on remote test station denoting the location, HVAC unit number, "RETURN", damper location, etc. as required to identify the detector's location and function.
- E. Automatic-Closing and Self-Closing Devices
- 1. Includes magnetic door holders, automatic doors and rolling fire shutters (provided by others)
 - 2. Provide magnetic door holder with the following specifications:
 - a. Minimum holding force of 25 lbs.
 - b. Surface, wall mounted.
 - c. Operates at 24 VDC from the fire alarm panel.
 - d. U.L. listed.
 - 3. Provide interface wiring between each closing device and the fire alarm system.
 - 4. Provide power to 24 VDC and 120 VAC closing devices.
 - 5. Provide addressable control module at each closing device to allow the main control panel to actuate each closing device independently.
 - 6. Provide unique address assignment for each self-closing device assigned by the main control panel.
 - 7. Provide addressable control module wiring between each closing device and the fire alarm system to allow the main control panel (through software) to operate the devices in either of two ways:
 - a. Any alarm in the building closes all automatic closing and self-closing devices.

- b. Only the detectors adjacent to the automatic closing and self-closing devices close the devices.
- F. Two Wire Detector Monitor Module
 - 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device.)
 - 2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
 - 3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits
- G. Addressable Control Module
 - 1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.
 - 2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y
 - 3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
 - 4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits.
- H. Addressable Releasing Control Module
 - 1. An addressable releasing module shall be available to supervise and control compatible releasing agent solenoids.
 - 2. The module shall operate on a redundant protocol for added protection.
 - 3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.
 - 4. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display.
 - 5. The module shall support programming of up to five programmable event thresholds.
- I. Addressable Relay Module:
 - 1. Addressable Relay Modules shall be available for HVAC control and other network building functions.
 - 2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
 - 3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
 - 4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

- J. Addressable Two-In / Two-Out Monitor/Relay Module:
1. An addressable Two-In/Two-Out module shall be available.
 2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
- K. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
- L. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- M. The isolator module shall not require address-setting, and its operations shall be automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- N. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
- O. Alarm Indicating Speakers
1. Provide alarm indicating speakers with the following specifications:
 - a. Temporal sounding pattern of ½ to 1 sec ON, followed by ½ to 1 second OFF for three cycles, followed by a 1½ to 2 second OFF period for no less than 180 seconds.
 - b. Semi-flush mounting to 4-inch square electrical box
 - c. 12VDC or 24 VDC operation powered from the main control panel.
 - d. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 70V systems. The actual speaker wattage and strobe candela setting shall be viewable from the device window to verify wattage setting, without removing the device. To make any changes to the speaker wattage will only require the removal of the cover plate.
 - e. Speaker shall be listed in compliance to produce 520Hz low frequency tone signal.
 - f. The following selectable sound level output:
 - 1) ¼ watt – 78 dBA
 - 2) ½ watt – 81 dBA
 - 3) 1 watt – 84 dBA
 - 4) 2 watt – 87 dBA
 - g. A minimum 90.5dB output at 10 feet on axis.
 - h. Frequency Range: 400 to 4,000 Hz (Fire Alarm), 200Hz – 15KHz (General signaling)
 - i. Red with white “Alert” lettering.
 - j. Supervised wiring.

- k. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
- l. U.L. listed, ADA compliant.

P. Alarm Indicating Strobes

1. Provide alarm indicating strobes with the following specifications:
 - a. Semi-flush mounting to 4-inch square electrical box
 - b. 24 VDC operation powered from the main control panel.
 - c. In rooms larger than 1600 square feet
 - 1) Minimum 120 candela when measured on axis.
 - 2) Rated for wall mount applications per UL 1971 at a minimum of 110 candela effective intensity.
 - d. Non-assembly rooms and corridors
 - 1) Minimum 75 candela when measured on axis
 - 2) Rated for wall mount applications per UL 1971 at a minimum of 15 candela effective intensity.
 - e. One to three flashes per second with a one (1) hertz synchronous flash pattern in accordance with ADA.
 - f. Red with white "Fire" lettering. Vandal-proof polycarbonate lens.
 - g. Supervised wiring
 - h. U.L. 1971 listed, ADA compliant

Q. Alarm Indicating Speaker/Strobe Unit

1. Provide alarm indicating speaker/strobes with the following specifications:
 - a. Temporal sounding pattern of ½ to 1 sec ON, followed by ½ to 1 second OFF for three cycles, followed by a 1½ to 2 second OFF period for no less than 180 seconds.
 - b. Semi-flush mounting to 4-inch square electrical box
 - c. 12VDC or 24 VDC operation powered from the main control panel.
 - d. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 70V systems. The actual speaker wattage and strobe candela setting shall be viewable from the device window to verify wattage setting, without removing the device. To make any changes to the speaker's wattage will only require the removal of the cover plate.
 - e. Speaker shall be listed in compliance to produce 520Hz low frequency tone signal.
 - f. The following selectable sound level output:
 - 1) ¼ watt – 78 dBA
 - 2) ½ watt – 81 dBA
 - 3) 1 watt – 84 dBA
 - 4) 2 watt – 87 dBA
 - g. A minimum 90.5dB output at 10 feet on axis.
 - h. Frequency Range: 400 to 4,000 Hz (Fire Alarm), 200Hz – 15KHz (General signaling)
 - i. In rooms larger than 1600 square feet
 - 1) Minimum 120 candela when measured on axis

- 2) Rated for wall mount applications per UL 1971 at a minimum of 110 candela effective intensity.
- j. Non-assembly rooms and corridors
 - 1) Minimum 75 candela when measured on axis
 - 2) Rated for wall mount applications per UL 1971 at a minimum of 15 candela effective intensity.
- k. One to three flashes per second with a one (1) hertz synchronous flash pattern in accordance with ADA.
- l. Red with white "Alert" lettering.
- m. Supervised wiring.
- n. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
- o. U.L. listed, ADA compliant

2.8 SYSTEM WIRE AND CABLE

- 1. Provide all conductors and cables in conformance with the National Electrical Code.
- 2. Size all initiating and indicating circuit wiring as recommended by the system manufacturer. Provide minimum 14 AWG size for indicating and control circuits, and 18 AWG for initiating circuits.
- 3. Provide shielded cable to minimize RFI if recommended by the manufacturer.
- 4. Provide maximum individual circuit voltage drop of 15% at the most distant device; or less if necessary to meet the manufacturer's operating voltage range for all devices.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide a complete and fully operational fire alarm and detection system as described herein and as shown on the drawings.
- B. Provide all wiring, conduit, junction boxes and outlet boxes required for the system, including terminations to initiate, indicating and control devices furnished by others.
- C. Install all wiring in concealed RED conduit. Conduits may be exposed in utilitarian spaces without finished walls and ceilings. Reuse existing conduit and boxes wherever possible.
- D. Paint all junction boxes red and label "Fire Alarm".
- E. Provide plain English description of the location of each initiating device (zone). Coordinate wording of each device with the Owner.
- F. Provide color coded wiring throughout. Test all wiring for loose terminations, shorts and grounds before system starts up.
- G. Terminate all fire alarm wiring at terminal strips at the main control panel and all annunciator panels. Identify each cable with a number corresponding to a wiring

diagram to be submitted in the O&M manuals. Neatly arranged cabling around the sides of the cabinets to facilitate servicing equipment and modules.

- H. Provide the required system of programming. Coordinate with the Owner all plain English address points, alarm verification presets, passwords, communication dialer protocol information, etc.
- I. Coordinate the installation of the fire alarm system with Division 23. Verify locations of sprinkler waterflow switches and valve position switch locations with Division 23. Provide wiring and make terminations to sprinkler waterflow devices and valve position switches being installed by Division 23.
- J. Provide and install power to magnetic door holders, including wiring and connections through the associated smoke detector. Wire existing magnetic door holder wiring through the associated smoke detector base for automatic closure if the smoke detector senses smoke.
- K. Provide and connect wiring from the duct smoke detector control modules to associated motor controllers.
- L. Install smoke detectors after the site is free from abnormal dust and dirt conditions or provide manufacturer-approved protective cover over the device until the site is clean.
- M. Provide permanent labels for controls and indicators.
- N. Provide Form C relays where required to control line voltage equipment.
- O. Mount fire alarm devices to electrical boxes.
- P. Locate automatic detectors a minimum of 36 inches away from supply air diffusers.

3.2 MOUNTING HEIGHTS

- A. Mounting heights of devices shall follow NFPA 72 and governing codes and requirements. Where not otherwise indicated, the following mounting heights above finished floor shall be used.
 - 1. Pull Stations: 48" to the operable device.
 - 2. Wall mounted audible notification devices: top above finished floor at height of not less than 90" and below the finished ceiling no less than 6".
 - 3. Wall mounted visual notification devices: entire lens is not less than 80" and not greater than 96" above finished floor.
- B. Devices of similar type shall be mounted at the same mounting height throughout the facility.

3.3 ELECTRIC FIRE AND SMOKE DAMPERS

- A. Provider of the electric dampers is responsible for getting power to the equipment under Division 23.
- B. Wiring for fire alarm and other life safety monitoring and alarm shall be provided under Division 28.
- C. Contractor is responsible for coordinating locations and requirements of the electric dampers with the equipment provider and the Mechanical Contract Documents.

3.4 TESTS AND ADJUSTMENTS

- A. Upon completion of the installation phase, test and adjust the system to ensure proper operation.
- B. Test all operational features of the system currently.
- C. Where required, make appropriate correction(s) and adjustments.
- D. A factory authorized service engineer of the fire detection and security systems manufacturer shall:
 - 1. Verify that all wiring connections are complete and correct.
 - 2. Make final adjustments of all sensing devices.
 - 3. Calibrate all equipment to obtain optimum performance.
 - 4. Instruct Owner's personnel in the proper maintenance of the systems and in the methods of making periodic checks and adjustments. Up to 8 hours of instruction shall be provided after the installation has been completed, tested, and commissioned.

3.5 AS-BUILT DOCUMENTATION

- A. Provide to the Engineer two (2) complete as-built manuals assembled in loose-leaf binders containing the following:
 - 1. As-built system functional block diagrams.
 - 2. Corrected copies of approved shop drawings
 - 3. As-built system wiring diagram.
 - 4. List indicating each device, location, address, label, etc.
 - 5. Final operating sequence (step by step) for the system as tested and accepted by the Fire Marshal.
 - 6. Hard copy printout of the complete fire alarm operating program, and a CD-ROM disk with programming software as written and customized for this project.
 - a. System operation manuals.
 - b. System maintenance manuals.
 - c. Name, address and phone number of the responsible service organization.

3.6 FINAL CHECKOUT AND ACCEPTANCE

- A. Demonstrate the operation and use of the system to the Architect/Engineer, to the Owner's representative(s) and the Fire Marshal.
- B. Verify the following before scheduling the system demonstration:
 - 1. System installation is complete.
 - 2. System is fully operational.
- C. Verify the following before requesting final approval:
 - 1. Owner training is complete.
 - 2. As-built documentation is complete and turned over to the Engineer.
- D. Provide a letter to the Owner certifying that the installation is complete, fully operational, and successfully tested.
- E. Final acceptance of the system will be given upon completion of all the above requirements.

3.7 SYSTEM GUARANTEE

- A. Provide a complete part and labor warranty for the system, commencing on the date of final acceptance and continuing for a period of one (2) year. Provide all materials and labor required to correct any system malfunction or failure (determined not to be the result of negligence, abuse, or misuse) at no charge to the Owner during this time.

3.8 MAINTENANCE

- A. Maintain a local service organization which is available to perform testing, inspection, repair and maintenance service on the system.
- B. Make available to the Owner a maintenance contract proposal from the system supplier to provide a minimum of two (2) inspections and test per year in compliance with NFPA-72 guidelines.

END OF SECTION

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