

Project Manual

CASS COUNTY COURTHOUSE
ANNEX RENOVATION
Fargo, North Dakota

CD Submittal



Fargo

225 Broadway N, Unit 700

Fargo, ND 58102

p 701.364.0237

Project Number: JLG 250105

Date: May 6, 2026

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SECTION 00 0105 - CERTIFICATIONS PAGE

CASS COUNTY COURTHOUSE
ANNEX RENOVATION

FARGO, NORTH DAKOTA

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 Registered Architect under the laws of the State of North Dakota.

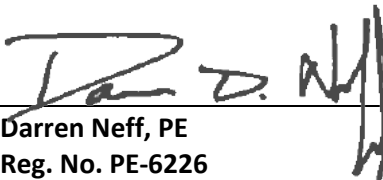


Tracy J. Jordre, AIA
Reg. No. 2031

May 6, 2026

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 Registered Professional Engineer under the laws of the State of North Dakota.

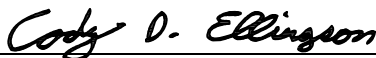


Darren Neff, PE
Reg. No. PE-6226

May 6, 2026

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 Registered Professional Engineer under the laws of the State of North Dakota.

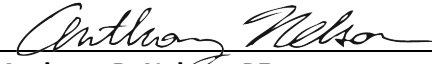


Cody Ellingson, PE
Reg. No. 7115

May 6, 2026

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 Registered Professional Engineer under the laws of the State of North Dakota.



Anthony R. Nelson, PE
Reg. No. PE-6251

May 6, 2026

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END OF SECTION

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CASS COUNTY COURTHOUSE

ANNEX RENOVATION

Fargo, North Dakota

Owner: Cass County Government

Sealed Bids for the Courtroom Remodeling, Cass County Courthouse, Fargo, North Dakota, will be received by Robert Wilson, Cass County Finance Office until 3:00 PM, Local Time, Tuesday, June 2, 2026.

Bids must be delivered before the time and date indicated above to the Cass County Finance Office in Cass County Courthouse, 211 9th St. South, Fargo, North Dakota 58103. Bids will be publicly opened and read aloud at 3:00 PM, Local Time, Tuesday, June 2, 2026, in the Commission Room, Cass County Courthouse, 211 9th St. South, Fargo, North Dakota 58103.

The Information to Bidders, Form of Bid, Form of Contract, Form of Performance-Payment Bond, Drawings, Specifications, Addenda, and other contract documents as prepared by JLG Architects may be examined at the following places:

The office of JLG Architects.

The Builders Exchange(s) in Fargo, Grand Forks, North Dakota.

Online at Construction Connect and Dodge Construction Network.

Bid Documents are available digitally to Prime bidders at the offices of JLG Architects, at no charge.

Each bid must be accompanied by a separate envelope containing the contractor's license and bid security. The bid security must be in a sum equal to five percent of the full amount of the bid and must be in the form of a bidder's bond. A bidder's bond must be executed by the bidder as principal and by a surety, conditioned that if the principal's bid is accepted and the contract awarded to the principal, the principal, within ten days after notice of the award, shall execute a contract in accordance with the terms of the bid, the bid bond, and any conditions of the governing body. Bids shall comply with North Dakota Century Code Chapter §48-01.2 as amended. If a successful bidder does not execute a contract within the time allowed, the bidder's bond shall be forfeited to the governing body and the project awarded to the next lowest responsible bidder.

No bidder may withdraw their bid within 30 days after the actual date of the opening thereof. The Bid Bond of the three lowest Bidders for each contract will be retained until the contract has been awarded and executed, but no longer than thirty (30) days after the date of the Bid.

All Bidders shall hold a valid North Dakota Contractor's license of the proper class for the full amount of the bid as required by North Dakota Law Sections §43-07-05 and §43-07-12 and shall enclose a copy of the license or Certificate of Renewal of the license in the same envelope as the Bidder's Bond. A Contractor shall be the holder of a license at least ten days prior to the date set for receiving Bids to be a qualified Bidder.

No bid will be read or considered which does not fully comply with the above requirements as to bond and licenses, and any deficient bid submitted must be resealed and returned to the bidder immediately.

Bids shall be in accordance with and submitted on the Bid form supplied within the Bid Documents. Failure to do so may result in rejection of the Bid. The Owner reserves the right to reject any and all bids and to waive any formalities therein and rebid the project until a satisfactory bid is received.

The successful Bidder will be required at the time the contract is executed to provide a certificate from and by the office of the State Tax Commissioner showing that all taxes due and owing to the State of North Dakota have been paid, Workers' Compensation Insurance Certificate, Certificate of Insurance to include North Dakota Stop Gap coverage, Company Safety Manual, Performance and Payment Bond, and Waiver of Subrogation.

A non-mandatory prebid walkthrough is scheduled for Thursday, May 14, 2026, at 10:00 am. Meet in the lobby of the Annex Building, 1019 3rd Ave S, Fargo, ND 58103.

END OF SECTION

SECTION 00 2113 - INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.01 DEFINITIONS

- A. 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, Bid Form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and all addenda issued prior to execution of the Contract.
- B. Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.
- C. Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications, or corrections.
- D. 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.
- E. The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.
- F. An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.
- G. A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.
- H. A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

1.02 BIDDER'S REPRESENTATIONS

- A. The Bidder by making a Bid represents that:
 - 1. The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.
 - 2. The Bid is made in compliance with the Bidding Documents.
 - 3. 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 personal observations with the requirements of the proposed Contract Documents.
 - 4. The Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception.

1.03 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

- A. The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies, or ambiguities discovered.

- B. Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.
- C. Interpretations, corrections, and changes to the Bidding Documents shall be made by Addendum. Interpretations, corrections, and changes to the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

1.04 SUBSTITUTIONS

- A. 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.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least seven days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. 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.
- C. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.
- D. No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

1.05 ADDENDA

- A. Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.
- B. Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- C. Addenda will be issued no later than three 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.
- D. Each bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

1.06 PREPARATION OF BIDS

- A. Bids shall be submitted on the forms included with the Bidding Documents.
- B. All blanks on the bid form shall be legibly executed in a non-erasable medium.
- C. Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.
- D. Interlineations, alterations, and erasures must be initialed by the signer of the Bid.
- E. It is requested that a change in cost be submitted for all Alternates. Failure to submit a cost change for an alternate may result in the Owner not being able to put together the project desired and cause the bid to not be considered. If no change in the Base Bid is required, enter "No Change."
- F. 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 make no additional stipulations on the bid form nor qualify the Bid in any other manor.

- G. Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the contract. A Bid by a corporation shall further give 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 agents authority to bind the Bidder.

1.07 RECEIPT AND OPENING OF BIDS

- A. Bids shall be received by the Owner as defined in the Advertisement or Invitation for Bids - Section 00 1113.
- B. Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.
- C. The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.
- D. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 30 days after the actual date of opening thereof.

1.08 SUBMISSION OF BIDS

- A. Each bid must be submitted in a sealed envelope bearing the following information on the outside:
 - 1. NAME OF THE PROJECT:
 - 2. NAME OF THE BIDDER:
 - 3. ADDRESS OF THE BIDDER:
 - 4. The words: BID PROPOSAL FOR CONSTRUCTION WORK.
- B. Oral, telephonic, telegraphic, facsimile, or other electronically transmitted bids will not be considered.

1.09 SUBCONTRACTS

- A. The bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner. Cause for rejection include, but are not limited to the following:
 - 1. Unacceptable workmanship on past projects.
 - 2. Lack of cooperation and/or inability to meet construction schedules on past projects.
 - 3. Inadequate personnel to meet construction schedule.
- B. The lowest bidder must submit to the Architect a complete list of all suppliers and subcontractors within seven days after the date of the bid. Inability to provide a list of acceptable subcontractors shall be just cause for rejection of the bidder's proposal.

1.10 MODIFICATION OF BIDS

- A. A Bid may not be modified, withdrawn, or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.
- B. Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worked as not to reveal the amount of the original Bid.

- C. Withdrawn Bids may be resubmitted to the date and time designated for the receipt provided that they are then fully in conformance with these Instructions to Bidder.

1.11 BID SECURITY

- A. Each bid must be accompanied by a Bid Bond attached thereto, duly executed by the bidder, as principal and having as surety thereon a surety company approved by the Owner in the amount of 5% of the bid. As soon as the BID prices have been compared, the Owner will return the BONDS of all except the three lowest responsible BIDDERS. When the CONTRACT is awarded, the BONDS of the two remaining will be returned. The BOND of the successful BIDDER will be retained under the AGREEMENT, Performance BOND and Payment BOND have been executed and approved, after which it will be returned. Signatures of all parties will be notarized.
- B. Bid Bonds shall be made payable to the Owner.
- C. The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

1.12 CONSIDERATION OF BIDS

- A. Opening of Bids: The properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.
- B. Rejection of Bids: The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.
- C. Acceptance of Bid (Award)
 - 1. It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgement, is in the Owner's own best interests.
 - 2. 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 low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

1.13 TIME OF COMPLETION

- A. Bidder agrees to commence work on or before a date to be specified in a written Notice to Proceed by the Owner and to fully complete the Construction Work as outlined in the project documents and as based on project alternates taken.

1.14 CONDITIONS OF WORK

- A. Each bidder must inform themselves fully of the conditions relating to the construction of the project. Failure to do so will not relieve a successful bidder of their obligation to furnish all materials and labor necessary to carry out their work and must employ such methods and/or means as will not cause any interruption of, or interference with the work of any other contractor.

1.15 PRE-BID CONFERENCE

- A. A Pre-Bid Conference will be held at the project site on Thursday, May 14th, 2026 at 10:00 AM local time. Meet in the Lobby of the Annex Building, 1019 3rd Avenue South, Fargo, North Dakota 58103. ~~After the conference, bidders will be able to tour the site.~~

1.16 BUILDING PERMIT

- A. The General Contractor shall include the cost of the building permit in their bid.

1.17 BUILDER'S RISK INSURANCE

- A. The General Contractor shall provide Builder's Risk Insurance.
- B. See AIA Document A201-2017 Subsection 11.5 for additional information and specification Section 00 7300 - Supplementary Conditions for modifications.

1.18 SECURITY FOR FAITHFUL PERFORMANCE

- A. Simultaneously with their delivery of the executed contract, each contractor shall furnish a Performance-Payment Bond as security for faithful performance of this contract and furnishing materials in connection with this contract. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner. The amount of the bonds shall be 100% of the contract.

1.19 POWER OF ATTORNEY

- A. Attorneys-in-fact who sign bonds on contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

1.20 LAWS AND REGULATIONS

- A. The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout and they will be deemed to be included in the contract the same as though herein written out in full.

1.21 OBLIGATION OF BIDDER

- A. At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and become thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect to their bid.

1.22 STATE EXCISE AND USE TAX (SALES TAX)

- A. In submitting the bid, the bidder is understood to have included in the bid price the state tax on all sales of building materials, supplies, and equipment to contractors, subcontractors, or builders for the erection of buildings or their alteration, repair, or improvement.

1.23 STORING MATERIALS OFF-SITE

- A. Contractor may store materials off-site and receive payment for said materials. If it is desired by the Contractor to order and store materials off-site, there shall be prior agreement to any arrangement by the Owner and Architect before ordering or Application for Payment. Evidence shall be furnished to the Owner and Architect that the materials have been ordered, delivered and paid for. A Certificate of Insurance for materials stored off-site shall accompany other required information at the time of the Application for Payment. The location of the stored materials shall be acceptable to the Owner.

1.24 OWNER REQUIREMENTS OF THE CONTRACTOR

- A. For Contract language that will be incorporated into AIA Owner-Contractor Agreements, see Project Manual Section 00 5000.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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
225 Broadway N, Unit 700
Fargo, ND 58102

Phone: 701-738-2495
Contact: Andrew Budke
abudke@jlgarchitects.com

PROJECT: Cass County Courthouse Annex Renovation, Fargo, North Dakota

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 4100 - BID FORM

TO: CASS COUNTY GOVERNMENT

DATE: JUNE 2, 2026

Having examined all bidding requirements, general conditions, Specifications and Drawings entitled (Annex Renovation), as prepared by JLG Architects, and having visited the site and examined all conditions affecting the work, the undersigned agrees to furnish and pay for all labor, materials, and equipment for the following Construction Contract as required by the afore mentioned documents for the following proposals:

STIPULATED SUM BASE BID FOR (MULTI-PRIME):

GENERAL CONSTRUCTION

_____ Dollars, (\$_____)

MECHANICAL CONSTRUCTION

_____ Dollars, (\$_____)

ELECTRICAL CONSTRUCTION

_____ Dollars, (\$_____)

STIPULATED SUM BASE BID FOR (SINGLE PRIME*):

GENERAL, MECHANICAL AND ELECTRICAL CONSTRUCTION

_____ Dollars, (\$_____)

NOTE: *Contractor may choose to provide a single prime bid. The single prime bid can only be awarded provided the apparent low single prime bid is less than or equal to the combined multiple prime apparent low bids.

ALTERNATES:

The undersigned agrees to perform Alternates (if required by Contract Documents) as described in the Contract Documents for the following cost as a change to the Base Bid Stipulated Sum stated above.

<u>Alt. #</u>	<u>Description</u>	<u>Amount</u>
<u>1</u>	<u>Exclude Bathroom Refresh, Floors 2-4</u>	<u>DEDUCT:</u>
	State the amount to be DEDUCTED from the Base Bid to provide all materials, labor & equipment required for new architectural finishes, plumbing fixtures and electrical and lighting fixtures in existing bathrooms (Rooms 203-204, 261, 263, 303-304, 343-344, 403-404), as indicated in the drawings and specifications.	
<u>2</u>	<u>Elevator Front Wall Only in lieu of Full Lobby Refresh, Floors LL-4:</u>	<u>DEDUCT:</u>
	State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required for architectural and electrical scopes in the security lobby, elevator cabs, and elevator lobbies (Rooms 001-002, 101-107, 201-202, 301-302, 401-402) less PLAM-3, as indicated in the drawings and specifications. Include doors marked by an asterisk (*) in the floor plan and door schedule.	
<u>3</u>	<u>Alternative Light Fixture Replacement Only at North Stair in lieu of Full Refresh:</u>	<u>DEDUCT:</u>
	State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required for all architectural scope and preferred light fixture replacement in North Stair (Rooms ST1-B through ST1-4). Implement alternative light fixture replacement instead, as indicated in the drawings and specifications. Include doors marked by a double asterisk (**) in the floor plan and door schedule.	
<u>4</u>	<u>Exclude 1975 Window Replacement:</u>	<u>DEDUCT:</u>
	State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required to replace existing SF-01 and SF-02 windows. Install storefront windows only at new openings on first floor, as indicated in the drawings and specifications.	
<u>5</u>	<u>Exclude West Stair Refresh:</u>	<u>DEDUCT:</u>
	State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required for architectural and electrical scopes in the West Stair (Rooms ST2-1 through ST2-4).	
<u>6</u>	<u>NOT USED</u>	<u>—</u>

- 7 Exclude Air Handler Replacement DEDUCT:
State the amount to be DEDUCTED from the Base Bid to provide all materials, labor & equipment required to replace AHU-4, 5, and 6, as indicated in the drawings and specifications.
- 8 Exclude Window Sill Replacement, Floors 2-4: DEDUCT:
State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required to install new SSM-3 window sills on floors 2 through 4 of the Annex, as indicated in the drawings and specifications.
- 9 Blinds in lieu of Roller Shades DEDUCT:
State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required to install WT-1 roller shades. Install WT-2 blinds instead, as indicated in the drawings and specifications.
- 10 Renovation for Juvenile Court: ADD:
State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required to renovate the 4th Floor, south wing of the Courthouse, as indicated in the drawings and specifications.
- 11 Upgrade to CAT6a Throughout Annex ADD:
State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required to install CAT6a cabling at all locations calling for CAT6 cabling throughout Annex, as indicated in the drawings and specifications.
- 12 Upgrade to Acoustical Glazing at Meeting Room: ADD:
State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required to install acoustical glazing and framing at room 322, as indicated in the drawings and specifications.

1.01

MISCELLANEOUS:

BIDDER has familiarized themselves with the nature and extent of the Contract Documents including Work, site, locality, and all local conditions, and Laws & Regulations that in any manner may affect cost, progress, performance, or furnishing of the Work.

BIDDER has given the Architect and its consultants written notice of all conflicts, errors, or discrepancies that it has discovered in the Contract Documents and the written resolution by the Architect is acceptable to BIDDER. The low bidder agrees to submit a list of sub-contractors (AIA G705) within 24 hours of the date of the bid. In submitting this bid, the undersigned agree that this bid shall not be withdrawn for a period of sixty days.

NOTE: THIS BID FORM SHALL BE SUBMITTED IN DUPLICATE.

SIGNED:

_____, a (Sole Proprietorship) (Partnership) (Corporation).

Firm Name (strike through two)

Street Address

City, State ZIP code

Phone: _____ Fax: _____

_____, _____
Signed By, Title

_____, _____
Signed By, Title

_____, _____
Signed By, Title

_____, _____
Witnessed By, Title

1. Sole Proprietorship: Signature of Sole Proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and the secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of director's authorizing them to do so, must be submitted with the Bid Form in the bid envelope.

END OF SECTION

SECTION 00 5000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.

1.02 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. The Agreement form is AIA A101.
- B. The General Conditions are AIA A201.

1.03 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.
- B. Bond Forms:
 - 1. Performance and Payment Bond Form: AIA A312.
- C. Post-Award Certificates and Other Forms:
 - 1. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).
- D. Clarification and Modification Forms:
 - 1. Architect's Supplemental Instructions Form: AIA G710.
 - 2. Construction Change Directive Form: AIA G714.
 - 3. Change Order Form: AIA G701.
- E. Closeout Forms:
 - 1. Certificate of Substantial Completion Form: AIA G704.

1.04 REFERENCE STANDARDS

- A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum; 2017.
- B. AIA A201 - General Conditions of the Contract for Construction; 2017.
- C. AIA A312 - Performance Bond and Payment Bond; 2010.
- D. AIA G701 - Change Order; 2017.
- E. AIA G702 - Application and Certificate for Payment; 1992.
- F. AIA G703 - Continuation Sheet; 1992.
- G. AIA G704 - Certificate of Substantial Completion; 2017.
- H. AIA G710 - Architect's Supplemental Instructions; 2017.
- I. AIA G714 - Construction Change Directive; 2017.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 7300 - SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

The following supplements modify, change, delete from, or add to the General Conditions of the Contract for Construction, AIA Document A201, 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1 GENERAL PROVISIONS

1.1 Basic Definitions

Add: 1.1.3.1 The term "provide" shall mean furnish and install in place.

1.1.5 After the paragraph, Add: The general character and scope of the Work is shown by the Drawings. Where a portion of the Work is fully drawn and the remainder is merely indicated, the portion fully drawn shall apply to all similar parts of the Work.

Add: 1.1.5.1 Figured dimensions on the Drawings shall be followed in preference to scaled measurements on the Drawings.

1.1.6 After the paragraph, Add: Where Specifications are abbreviated type, they indicate complete sentences in the same manner as when a note occurs in the Drawings. Omissions of words such as "the Contractor shall" and "as shown on the Drawings" is intentional. The words "shall" or "shall be" are to be supplied by inference.

Add: 1.1.6.1 Where a number is listed in the Specifications (as for gauges, weights, temperatures, amounts of time, etc.), the number shall be interpreted as that or better.

1.2 Correlation and Intent of the Contract Documents

Add: 1.2.4 In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided.

Add: 1.2.5 As experienced Contractors and Subcontractors, it is assumed each Contractor and Subcontractor understands not all components may be shown on the Drawings including, but not limited to, fasteners, connectors and incidental supports. This shall not relieve the Contractors or Subcontractors from providing all materials, equipment, fasteners, and incidental components as required for a complete installation in accordance with the design intent.

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

Add: 1.5.2.1 The Contractor(s) may retain one record set of Drawings and Project Manual(s).

1.6 Notice

1.6.1 omit the words "if a method for electronic transmission is set forth in the Agreement".

ARTICLE 2 OWNER

2.3 Information and Services Required of the Owner

2.3.6 Replace the text with: The Contractor(s) will be furnished as many sets of Drawings and Project Manuals as the Architect has available for distribution, but in no case less than one. If the Contractor(s) require additional sets, an electronic copy of the documents will be provided in Adobe PDF format with which the Contractor(s) may use to make additional copies at their expense.

ARTICLE 3 CONTRACTOR

3.2 Review of Contract Documents and Field Conditions by Contractor

3.2.1 Add the words "including the geotechnical report (if any)," following the word "performed,".

3.4 Labor and Materials

Add: 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider requests for the substitution of products in place of those specified. The Owner and Architect may, but are not obligated to, consider only those substitution requests that are in full conformance with the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:

- .1 represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to the product specified;
- .2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
- .3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be performed or changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent;
- .4 agrees that it shall, if the substitution is approved, coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects; and
- .5 represents that the request includes a written representation identifying any potential effect the substitution may have on the Project's achievement of a Sustainable Measure or the Sustainable Objective.

Add: 3.4.4 No trade shall commence Work until conditions are satisfactory for carrying out the Work properly, and surfaces to be covered are suitable.

Add: 3.4.5 Manufacturer's printed instructions covering details of installation shall be followed where not in conflict with these Specifications. If there is a conflict, notify the Architect and obtain Architect's approval before proceeding.

Add: 3.4.6 Completed Work shall be left plumb, level, true to line or plane, anchored securely in place, and free from damage.

Add: 3.4.7 Unless otherwise called for, all pieces of material shall be as large a stock size as is in conformity with standard good practice of the trade.

Add: 3.4.8 Except where in conflict with the Specifications, current manufacturer's printed instructions of herein specified proprietary products are made part of the Specifications.

Add: 3.4.9 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

Add: 3.4.10 The Contractor shall provide all incidental materials and components including, but not limited to, fasteners, connectors, incidental supports and other components of construction as required for complete installation in accordance with the design intent.

3.5 Warranty

Add: 3.5.1.1 The Contractor further warrants that all products, materials and equipment provided under the Contract are asbestos-free as defined under current EPA Guidelines, and that they do not contain any other materials currently known to be hazardous.

3.7 Permits, Fees, Notices and Compliance with Laws

3.7.1 Change the word "...Contractor..." to read "...General Contractor..."

Add: 3.7.2.1 When the Contract Documents require Work better than that required by statute, the Contract Documents shall govern.

3.12 Shop Drawings, Product Data and Samples

Add: 3.12.6.1 If the Contractor or any Subcontractor uses a material, product or piece of equipment which requires modification(s) to any other portion of the Work, including mechanical and electrical Work, the Contractor or Subcontractor using that material, product or piece of equipment shall be responsible for coordinating all required modifications and shall bear the full cost of such modifications.

ARTICLE 4 ARCHITECT

4.2 Administration of the Contract

4.2.3 Add to the end of paragraph: The Architect will not be responsible for the acts or omissions of the Owner.

ARTICLE 5 SUBCONTRACTORS

5.1 Definitions

Add: 5.1.3 All Subcontractors are bound to the terms of the General and Supplementary Conditions.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

No supplement.

ARTICLE 7 CHANGES IN THE WORK

7.1 General

Add: 7.1.4 All proposals shall, at a minimum, include detailed breakdown and indicate the terms enumerated below. Item (a) constitutes the cost of labor, and items (a), (b), and (c) constitute the basic costs referred to under this Article 7.

(a) Labor costs, itemized by each trade involved, showing the hourly rates for each, and the hours required for the change. Labor rates shall be the same for extra and credit computations and shall be the actual rate paid the workmen, plus contractor's burden on labor, which shall be only the actual costs of fringe benefits, taxes on labor, worker's or workmen's compensation, insurance on labor as affected by payroll, unemployment taxes and insurance, including FICA and FUTA.

(b) Quantities of materials, equipment and supplies, at their actual cost, with unit costs indicated, plus applicable sales tax.

(c) The cost of subcontracted work, computed in the same way as provided for under this subparagraph.

(d) Overhead, profit or commission added after the above computations are complete. Such overhead, profit or commission shall be computed in accordance with the provisions of subparagraph 7.1.5.

Add: 7.1.5 Maximum allowances for Subcontractor's/Contractor's overhead and profit shall be as follows, expressed as a percentage of the basic cost of the change:

For Subcontractors:	a. 15% of the net cost of the additional Work.
For Contractor:	b. 5% of the net cost of the additional Work performed by Subcontractors
	c. 15% of the net cost of the work performed by Contractor's own forces.
	Add 5% to a and c for all changes of less than \$500.00; deduct 5% from a and c for all changes over \$10,000.00.

Overhead and profit shall include all bond premiums (if applicable), and will not be allowed on labor costs if overhead and profit is already included in hourly billing rate.

Add: 7.1.6 For proposed changes in the Work on the lump sum or time and material methods, the costs shall be determined as provided in this subparagraph. The Contractor shall submit an itemized list of

quantities with the applicable unit costs and extended price for each, in such form and detail as required by the Architect.

7.2 Change Orders

7.2.2 Neither the Owner nor the Architect are responsible to give Notice of Change Orders to the surety.

7.3 Construction Change Directives

7.3.2 At the end of the sentence, Add: "or as deemed necessary by the Architect".

7.3.4 At the end of the first sentence replace "a reasonable allowance for overhead and profit." with "allowances for overhead and profit as indicated in 7.1.5."

ARTICLE 8 TIME

8.1 Definitions

Add: 8.1.3.1 Minor corrective Work and the replacement of defective Work or materials, and the adjustment of control apparatus, will not delay the determination that the Contract is Substantially Complete.

Add: 8.1.3.2 The date of Final Completion is the date certified by the Architect in accordance with Paragraph 9.10.2.

8.3 Delays and Extensions of Time

Add: 8.3.1.1 The following will not be considered justifications for extension of time unless due to one of the causes stated within Article 8:

- a) Delay caused by Subcontractors or Supplier except if the Supplier goes out of business and another Supplier cannot be found in time to meet the schedule.
- b) Shortage of workers.

Add: 8.3.1.2 Change Orders for extension of Contract Time shall be considered only under the following conditions or circumstances:

.1 As indicated in Paragraph 8.3.1. The burden of proof to substantiate the extension of time shall rest with the Contractor, including evidence that the cause was beyond their control. The Contractor shall be deemed to have had control of the supply of labor (except in the case of organized labor disputes), materials, equipment, methods, and techniques, and of the Subcontractors.

.2 A delay in the progress of the Work actually occurred as a result of one of the valid causes for time extension.

.3 Unusual delay in delivery solely due to a delay in transportation. An extension of time shall not be considered when delay in delivery is due to improperly scheduled delivery, or when an order has not been promptly and properly placed.

.4 Abnormal weather conditions. The Contractor shall consider the location of the Project, and shall recognize the existence of variations from severe deviations from average climatic conditions. Foul weather in and of itself shall not be a valid cause for a time extension. Time extensions resulting from abnormal weather shall not be considered unless a significant deviation from average seasonal climatic conditions occurred for an extended period of time, and the progress of the Work was delayed to a significant extent. The climatic conditions before and after the period for which the delay is sought shall be evaluated.

.5 Changes in the Work which significantly affect the progress of the Work. When the anticipated delay can be determined the extension will be made when the Change in Work is authorized by the Owner. When the anticipated delay cannot be determined, the Contractor shall estimate the additional time required, and a mechanism for all parties to determine the allowable delay. In such a case, the Architect will determine the time extension and the Contract Time adjusted accordingly by Change Order. For changes in the Work which affect only a portion or Phase of the

entire project, the Owner reserves the right to grant a time extension only for that portion or Phase affected by the Change.

.6 Labor disputes except for lockouts over which the Contractor has control. The amount of time extension shall not be longer than the actual dispute period plus a reasonable time for mobilization, and such extension may be less than the actual dispute period depending on the effect the dispute had upon the progress of the Work.

.7 Unavoidable delays such as damage caused by severe weather, fire or other casualty to the Work; remediation of contaminants, pollutants, or hazardous materials or substances discovered after award of the Contract; litigation including without limitation bankruptcy proceedings; the acts of any federal, state or local government unit that directly result in delays; and other delays outside the control of the Party claiming the delay.

.8 Delays caused by Subcontractors shall be considered only under the conditions noted above.

.9 Time extensions may be granted through a change order for substantiated abnormal weather conditions, however, no change to the contract price will be granted.

Add: 8.3.1.3 Time extensions shall not be granted as a result of delays caused by improper scheduling, or by failure of the Contractor to have Shop Drawings or other required submittals submitted in sufficient time for review.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 Contract Sum

9.1.2 Add sentence at end: "The costs for overhead, profit and commission shall be determined in accordance with the provisions of subparagraph 7.1.5."

9.3 Applications for Payment

9.3.1 In the first sentence replace: "At least ten days before the date established for each progress payment," with: "Not more than once a month,".

9.3.2 Replace the text with: Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered to and suitably stored at the site for subsequent incorporation into the Work. Contractor shall not receive payment for materials and equipment stored off site. Payment for materials and equipment stored on the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment, or otherwise protect the Owner's interest, including applicable insurance.

Add 9.3.4 Progress payments shall be made monthly upon application, in the amount of 90% of the Work completed and materials described under 9.3.2. For a Contract of over \$100 thousand, the Architect will authorize the payment of 100% of the amount completed after a total of 5% of the Contract amount has been retained, providing progress on the Work is in accordance with or ahead of the Contractor's construction schedule and is satisfactory to the Architect and if the Contractor has filed a Consent of Surety with the Architect.

9.8 Substantial Completion

9.8.1 At the end of the paragraph Add: In all cases, the date of the Substantial Completion may not be earlier than the Certificate of Occupancy issued by the authority having jurisdiction. Minor corrective Work, the replacement of defective Work or materials, and the adjustment of control apparatus will not delay the determination of Substantial Completion. See paragraph 12.2.2.

9.8.2 At the end of the paragraph Add: Minor punch list items that do not interfere with using the Work as intended may be corrected between Substantial Completion and Final Completion.

9.10 Final Completion and Final Payment

9.10.2 After "warranties or specific Subcontractor warranties," DELETE "and (6)" and REPLACE WITH ", (6) written certification from Contractor in accordance with Final Inspection requirements of Section 01 7800, (7) all Contract Closeout submittals required by Section 01 7800, each submittal having been approved by the Architect, and (8)".

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.3 Hazardous Materials and Substances

10.3.1 In the second sentence after: "asbestos", Add: ", lead-containing materials,"

ARTICLE 11 INSURANCE AND BONDS

11.1 Contractor's Insurance and Bonds

11.1.2 Replace the first sentence with: The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required in the Agreement or elsewhere in the Contract Documents, covering the faithful performance of the Contract and the payments of all obligations arising thereunder.

11.1.3 Replace paragraph with: The Contract will not be executed by the Owner until the Owner has received, from the Contractor, the properly executed surety bonds specified in AIA A101-2017 Exhibit A Insurance and Bonds.

11.5 Adjustment and Settlement of Insured Loss

11.5.1 At the end of the first sentence add: "except when the fiduciary consents to allow a party with a claim to settle directly with the insurer."

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

No supplement.

ARTICLE 13 MISCELLANEOUS PROVISIONS

No supplement.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.2 Termination by the Owner for Cause

14.2.1.2 At the end of the Subparagraph Add "or in accordance with the Contract Documents".

Add: 14.2.1.5 files a bankruptcy petition or has a bankruptcy action commenced against it that is not discharged within 30 days of commencement of same, makes an assignment for the benefit of its creditors, has a receiver appointed to manage the Contractor's assets or otherwise becomes insolvent;

Add: 14.2.1.6 fails to maintain schedules as required by the Contract Documents, or fails to comply in a material way with design requirements of the Contract Documents, or persistently fails to perform the Work in accordance with the Contract Documents.

14.2.4 Replace the text with: If the unpaid balance of the Contract Sum exceeds the direct and indirect consequential costs of completing the Work (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs), and other damages incurred by the Owner, such excess will be paid to the Contractor. If such costs and damages exceed such unpaid balance, the Contractor shall pay the difference to the Owner. Such costs incurred by the Owner will be approved as to reasonableness by the Architect, but when exercising any rights or remedies under this paragraph, the Owner shall not be required to obtain the lowest price for the Work performed. This obligation to payment shall survive termination of the Contract.

ARTICLE 15 CLAIMS AND DISPUTES

15.1.6 Claims for Additional Time

Add: 15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

Add: 15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor

AIA DOCUMENT A101-2017 EXHIBIT A

ARTICLE A.1 - GENERAL

Add: Reference to "all-risks" in this document shall mean builder's risk policy.

ARTICLE A.2 - OWNER'S INSURANCE

A.2.3 Required Property Insurance

A.2.3.1 Modify paragraph to read: Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Architect, Engineers Contractor, Subcontractors, and Sub subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees. This insurance is not intended to cover machinery, tools or equipment owned or rented by the Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage per Article A.3.3.2.5 for owned or rented machinery, tools or equipment which shall be subject to the provisions of the General Conditions, Article 11.3 Waivers of Subrogation.

ARTICLE A.3 - CONTRACTOR'S INSURANCE AND BONDS

A.3.1 General

A.3.1.1 Replace the third sentence with: The certificates will show the Owner and Architect as additional insured on the Contractor's Commercial General Liability and umbrella liability policy or policies.

A.3.2 Contractor's Required Insurance Coverage

A.3.2.1 Add to end of paragraph: The Architect and Owner assume no responsibility in the event that the limits set below are not adequate.

A.3.3 Contractor's Other Insurance Coverage

A.3.3.2.1 In fifth sentence replace "Owner" with "(General) Contractor". See Article 11.5 of both the General Conditions and Section 00 7300 Supplementary Conditions for additional information.

Add: A.3.3.2.1.1 If the Owner is damaged by the failure of the [General] Contractor to maintain this insurance, then the [General] Contractor shall bear all reasonable costs properly attributable thereto.

A.3.3.2.4 Add to end of paragraph: The Contractor shall provide this insurance if storing materials and equipment off-site. See article 9.3.2 of the General Conditions and Section 00 7300 Supplementary Conditions for additional requirements relating to materials or equipment stored off-site.

A.3.4 Performance Bond and Payment Bond

Delete second paragraph beginning "Payment and Performance Bonds..."

Add: A.3.4.1 Where there are State, Federal or other jurisdictional bond forms required by statute or regulation, the bond or bonds shall be on those forms, in the amount of 100% of the Contract amount. Where no such requirements exist, the Contractor shall furnish both AIA A312 Performance and AIA A312 Labor and Material Payment Bond, current as of the date of the agreement. Each bond, Performance and Payment shall be in the amount of 100% of the Contract amount.

Add: A.3.4.2 The Contractor shall require the attorney-in-fact who executes the required surety bonds on behalf of the surety to affix thereto a certified and correct copy of the power of attorney.

Add: A.3.4.3 Bond amounts shall not exceed the single bond limit for the Contractor's bonding company as set forth in the Federal Register current as of the bid date.

END OF SECTION

SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.01 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.

1.02 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.
- E. Work hours restrictions for certain demolition scopes are indicated on the Drawings.

1.03 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Contractors shall not use the building elevators without prior permission from Cass County Government.
- C. 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.
- D. Existing building spaces may not be used for storage.
- E. 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 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 00 5000 - Contracting Forms and Supplements: Forms to be used.

1.03 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values to the Architect at the earliest feasible date, but in no case later than seven days before the date scheduled for submittal of the initial application for payment.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section.
 - 1. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports.
 - 2. Break principle subcontract amounts down into several line items.
 - 3. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
 - 4. For each part of the Work where an Application for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - 5. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Application for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
 - 6. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
- E. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - 1. Contractor's construction schedule.
 - 2. Application for Payment form.
 - 3. List of subcontractors.
 - 4. List of principal suppliers and fabricators.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.

- B. Forms filled out by hand will not be accepted.
- C. Execute certification by signature of authorized officer.
- D. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- E. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- F. Submit three copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien, payroll reports, and/or similar attachments, when required.
 - 1. One approved copy will be retained by the Architect, one will be returned to the Contractor, and one forwarded to the Owner for their use in issuing payment.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
 - 1. List of subcontractors: AIA G705.
 - 2. List of principle suppliers and fabricators.
 - 3. Schedule of Values: AIA G703.
 - 4. Submittal schedule.
 - 5. Contractor's Construction Schedule (preliminary if not final).
 - 6. Schedule of principal products.
 - 7. List of Contractor's staff assignments.
 - 8. Certificates of insurance and insurance policies.
 - 9. Performance and payment bonds: AIA A312.
- H. Include the following with each application:
 - 1. Waivers of Mechanics Lien: Submit waivers of mechanics lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the payment.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3216.
 - 3. Affidavits attesting to off-site stored products.
- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 - 1. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Testing, adjusting, and balancing reports.
 - d. Maintenance instructions.
 - e. Start-up performance reports.
 - f. Change-over information related to Owner's occupancy, use, operation, and maintenance.
 - g. Final cleaning.
 - h. Application for reduction of retainage, and consent of surety.
 - i. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

1.05 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue Supplemental Instructions on AIA form G710 directly to Contractor.
- B. Change Orders: For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
 - 1. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - a. Proposal requests issued by the Architect are for information only. Do not consider Proposal Requests as an instruction either to stop work in progress, or to execute the proposed change.
 - b. Unless otherwise indicated in the proposal request, within 5 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
 - c. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - d. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - e. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
 - 2. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
 - a. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 - b. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - d. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of a product or system for a product or system specified.
 - 3. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.
- C. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 3. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. Maximum allowances for Subcontractor's/Contractor's overhead and profit as expressed as a percentage of the basic cost of the change:
 - a. Subcontractors: 15% of the net cost of the additional Work.
 - b. Contractors: 5% of the net cost of the additional Work performed by subcontractors.
 - c. Contractors: 15% of the net cost of work performed by the contractor's own forces.
 - d. Add 5% to above allowances for changes of less than \$500.00.
 - e. Deduct 5% from above allowances for changes greater than \$10,000.00.
 - f. Overhead and profit shall include all bond premiums (if applicable), and will not be allowed on labor costs if overhead and profit is already included in hourly billing rate.
- E. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- G. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- H. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 01 7000.
 2. Completion of items specified for completion after Substantial Completion (punchlists).
 3. Assurance that unsettled claims will be settled.
 4. Assurance that Work not complete and accepted will be completed without undue delay..
 5. Transmittal of required construction records to Owner.
 6. Proof taxes, fees, and similar obligations have been paid.
 7. Removal of temporary facilities and services.
 8. Removal of surplus materials, rubbish, and similar elements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100 - ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cash and material allowances.
- B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

- A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH AND MATERIAL ALLOWANCES

- A. Costs Included in Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts.
- B. Architect Responsibilities:
 - 1. Consult with Contractor for consideration and selection of products, suppliers .
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
 - 3. Prepare Change Order.
- C. Contractor Responsibilities:
 - 1. Assist Architect in selection of products, suppliers , and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- D. Differences in costs will be adjusted by Change Order.

1.04 ALLOWANCES SCHEDULE

- A. Landscaping: Provide an allowance for \$ for Plantings, Lawn Seeding and Mulch.
- B. Construction Barrier: Provide an allowance for 40 carpentry hours and a \$2500.00 material allowance for erection of temporary construction barriers installed at discretion of the Owner and/or Architect.
Any unused balance shall be credited to the Owner via Change Order at the conclusion of the project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.
- C. Documentation of changes to Contract Sum and Contract Time.

1.02 DEFINITIONS

- A. Alternate: An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.
- C. Work Included Under Each Alternate: Make modifications to work required by each alternate selected at no additional cost to the Owner other than as proposed on the Bid Form. Bidders shall be responsible for alternates and shall see that all changes are covered under their related sections, whether specifically called out or not. Extra costs incurred due to modifications to or deviations from the Drawings or Specifications caused directly or indirectly by each alternate shall be included in each alternate bid.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Exclude Bathroom Refresh, Floors 2-4:
 - 1. State the amount to be DEDUCTED from the Base Bid to provide all materials, labor & equipment required for new architectural finishes, plumbing fixtures, and electrical and lighting fixtures in existing bathrooms (Rooms 203-204, 261, 263, 303-304, 343-344, 403-404), as indicated in the drawings and specifications.
- B. Alternate No. 2: Elevator Front Wall Only in lieu of Full Lobby Refresh, Floors LL-4:
 - 1. State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required for architectural and electrical scopes in the security lobby, elevator cabs, and elevator lobbies (Rooms 001-002, 101-107, 201-202, 301-302, 401-402) less PLAM-3, as indicated in the drawings and specifications. Include doors marked by an asterisk (*) in the floor plan and door schedule.
- C. Alternate No. 3: Alternative Light Fixture Replacement Only at North Stair in lieu of Full Refresh:
 - 1. State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required for all architectural scope and preferred light fixture replacement in North Stair (Rooms ST1-B through ST1-4). Implement alternative light fixture replacement instead, as indicated in the drawings and specifications. Include doors marked by a double asterisk (**) in the floor plan and door schedule.
- D. Alternate No. 4: Exclude 1975 Window Replacement:

1. State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required to replace existing SF-01 and SF-02 windows. Install storefront windows only at new openings on first floor, as indicated in the drawings and specifications.
- E. Alternate No. 5: Exclude West Stair Refresh:
 1. State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required for architectural and electrical scopes in the West Stair (Rooms ST2-1 through ST2-4).
- F. Alternate No. 6: NOT USED
- G. Alternate No. 7: Exclude Air Handler Replacement:
 1. State the amount to be DEDUCTED from the Base Bid to provide all materials, labor & equipment required to replace AHU-4, 5, and 6, as indicated in the drawings and specifications.
- H. Alternate No. 8: Exclude Window Sill Replacement, Floors 2-4:
 1. State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required to install new SSM-3 window sills on floors 2 through 4 of the Annex, as indicated in the drawings and specifications.
- I. Alternate No. 9: Blinds in lieu of Roller Shades:
 1. State the amount to be DEDUCTED from the Base Bid to exclude all materials, labor & equipment required to install WT-1 roller shades. Install WT-2 blinds instead, as indicated in the drawings and specifications.
- J. Alternate No. 10: Renovation for Juvenile Court:
 1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required to renovate the 4th Floor, south wing of the Courthouse, as indicated in the drawings and specifications.
- K. Alternate No. 11: Upgrade to CAT6a throughout Annex:
 1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required to install CAT6a cabling at all locations calling for CAT6 cabling throughout Annex, as indicated in the drawings and specifications.
- L. Alternate No.12: Upgrade to Acoustical Glazing at Meeting Room:
 1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required to install acoustical glazing and framing at room 322, as indicated in the drawings and specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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 Cass County Government.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Cass County Government and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. 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.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

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. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Submittals for review, information, and project closeout.
- F. Number of copies of submittals.
- G. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
- B. Section 01 6000 - Product Requirements: General product requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: Use one of the following:

1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
 2. EADOC LLC (tel: 1-877-305-3844): www.eadocsoftware.com/#sle.
 3. Newforma ConstructEx: www.newforma.com/our-solutions/constructex/#sle.
 4. Procor
- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
1. Owner.
 2. Architect.
 3. Contractor.
 4. Major subcontractors.
- C. Agenda:
1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 6. Scheduling.
 - a. Contractor's schedule.
 - b. Start of on-site work.
 - c. Completion date.
 - d. Coordination with on-site Owner's representatives.
 - e. Sequence of work.
 - f. Full or partial Owner occupancy as applicable.
 7. Shop drawings and sample distribution.
 8. Mockups.
 9. Critical products for the project timeline.
 10. Material deliveries.
 11. Procedures to be followed when working on site.
 12. Address items prior to on-site work.
 - a. Parking.
 - b. Security.
 - c. Temporary Facilities including heat, electricity and water.
 - d. Noise and general safety.
 - e. Site fencing.
 - f. Use of the site.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CLOSEOUT MEETING

- A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Applicable subcontractors.
- D. Agenda:
 - 1. Starting Systems and Owner Training.
 - a. Mechanical.
 - b. Electrical.
 - c. Specialty Systems, i.e. Elevator.
 - d. Testing, adjusting and balancing.
 - e. Startup logs.
 - 2. Project Record Drawings.
 - 3. Record Project Manuals.
 - 4. Project Record Submittals.
 - 5. Warranties and Special Warranties.

6. Spare parts, extra stock materials.
 7. Contractors initial punchlist.
 8. Architects review of punchlist.
 9. Certificate of Occupancy.
 - a. Partial Occupancy.
 - b. Temporary Occupancy.
 10. Consent of Surety of Final Payment.
 11. Final Payment and Retainage Reduction.
 12. Affidavit of Liens and Waivers.
 13. Insurance Coverages.
 - a. Property.
 - b. Liability.
 14. 11 Month Warranty.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216

3.06 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.

3.07 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.

3.08 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.

3.09 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.

3.10 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.

3.11 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.

3.12 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.

3.13 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 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 Cass County Government'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 Cass County Government'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 Cass County Government'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 Cass County Government.
 - 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 Cass County Government.
 - 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. Cass County Government 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 Cass County Government'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 Cass County Government.
- 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 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 DEFINITIONS

- A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
 - 1. Special inspections and tests are separate from and independent of tests and inspections conducted by Cass County Government or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

- A. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.
- B. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2025, with Editorial Revision.
- C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to start of work, Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
 - 4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
- C. Testing Agency Qualifications: Prior to start of work, Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

3. Submit certification that Testing Agency is acceptable to AHJ.
4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with contract documents.
 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- E. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.
 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 or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with contract documents.
- F. Certificates: When required by AHJ, Special Inspector will submit certification by manufacturer, fabricator, and installation subcontractor to Architect and AHJ.
 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 and AHJ.
- G. Fabricator's Inspection Reports: When required by AHJ, submit reports to Architect and AHJ.
 1. Submit report in duplicate within 30 days of observation to Architect for information.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

- A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC)-2018.
- B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcement, Including Prestressing Tendons, and Verification of Placement: Verify compliance with ACI CODE-318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.
- B. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI CODE-318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.
- C. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI CODE-318.
 - 1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
 - 2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.
- D. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI CODE-318, Chapter 19, 16.4.3, 26.4.4; periodic.
- E. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M, and ACI CODE-318, Chapter 26.5, 26.12, and record the following, continuous:
 - 1. Slump.
 - 2. Air content.

3. Temperature of concrete.
- F. Specified Curing Temperature and Techniques: Verify compliance with ACI CODE-318, Chapter 26.5.3 through 26.5.5; periodic.
- G. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI CODE-318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI CODE-318, Chapters 19 and 20.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
 1. Inspections and Approvals:
 - a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
 - b. Verify approval of submittals required by Contract Documents; periodic.
 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 4. Joints and Accessories: When masonry construction begins, verify:
 - a. Proportions of site prepared mortar; periodic.
 - b. Construction of mortar joints; periodic.
 - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
 5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
 - a. Size and location of structural elements; periodic.
 - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
 - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
 - d. Welding of reinforcing bars; continuous.
 - e. Preparation, construction and protection of masonry against hot weather above 90 degrees F (50 degrees C) and cold weather below 40 degrees F (22 degrees C); periodic.
 - f. Application and measurement of prestressing force; continuous.
 6. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

3.05 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 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 reference standards.
 4. Ascertain compliance of materials and products 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 or inspections specified.
- B. Limits on Special 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.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.06 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
1. Test samples 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 or inspections specified.
- B. Limits on Testing or 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.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.07 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Cass County Government's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.08 FABRICATORS' FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to 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 Cass County Government.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary telecommunications services.
- B. Temporary sanitary facilities.
- C. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

- A. Section 01 5813 - Temporary Project Signage.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.04 QUALITY ASSURANCE

- A. Regulations: All contractors, sub-contractors, and suppliers shall comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police Department, Fire Department, and Rescue Squad rules.
 - 5. Environmental protection regulations.
 - a. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.
- B. Standards: All contractors, sub-contractors, and suppliers shall comply with NFPA Code 241, "Building Construction and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
- C. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services," prepared by AGC and ASC for industry recommendations.
- D. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions.
- E. All contractors, sub-contractors, and suppliers shall provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- F. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
- G. Lumber and Plywood: Comply with requirements in Section 06 1000 - Rough Carpentry.
- H. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electrical service. Install service in compliance with the National Electrical Code (NFPA 70).

- I. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures, construction operations, and similar elements.
- J. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

1.05 DIVISION OF RESPONSIBILITIES

- A. Each Prime Contractor is responsible for specific temporary services and facilities used by other Prime Contractors, and other entities on site. The General Contractor is responsible for providing temporary services and facilities that are not normal to the construction activities of other Prime Contractors, and are not specifically assigned otherwise by the Architect.
- B. Each prime Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed
- C. Each prime Contractor shall prepare a schedule indicating dates for the implementation and termination of each temporary utility for which it is responsible.
- D. At the earliest feasible time, when acceptable to the Owner, change over from the use of the temporary service to use of the permanent service.
- E. Temporary use of permanent facilities: The Installer of each permanent service or facility shall assume responsibility for its operation, maintenance, and protection during its use as a construction service or facility prior to the Owner's acceptance, regardless of previously assigned responsibilities.
 - 1. Other entities using temporary services and facilities include, but are not limited to:
 - a. Other non-prime contractors.
 - b. The Owner's workforces.
 - c. Occupants of the Project.
 - d. The Architect.
 - e. Testing Agencies.
- F. Each prime Contractor is responsible for:
 - 1. Installation, operation, maintenance, and removal of each temporary service or facility usually considered as its own normal construction activity, as well as the costs and use charges associated with each such service or facility.
 - 2. Plug-in electric power cords and extension cords, and supplementary plug-in task lighting and special lighting necessary exclusively for its own activities.
 - 3. Their own field office, complete with necessary furniture, utilities and telephone service.
 - 4. Their own storage and fabrication shed as required.
 - 5. Temporary heat, ventilation, humidity control, and enclosure of the building where these utilities are necessary for its construction activity, but where these utilities have not yet been installed by the responsible prime Contractor.
 - 6. Collection and disposal of its own hazardous, dangerous, unsanitary, or other harmful waste material.
 - 7. Recycling of waste materials.
 - 8. Each major trade working on the site shall provide one man for two hours per week for cleanup of the building and site, to be coordinated by the General Contractor. The General Contractor shall provide sweeping compound and other clean-up materials.
 - 9. Secure lockup of their own tools, materials, and equipment.
 - 10. Construction aids and miscellaneous services and facilities necessary exclusively for their own construction activities.
 - 11. Environmental protection.

- G. The Contractor for General Construction is responsible for:
 - 1. Temporary field office for construction progress meetings.
 - 2. Temporary roads and road maintenance including snow removal.
 - 3. Site snow removal.
 - 4. Temporary portable toilets, including disposable supplies.
 - 5. Temporary wash facilities, including disposable supplies.
 - 6. Temporary enclosure of the building.
 - 7. Temporary portable fire extinguishers.
 - 8. General collection and disposal of wastes.
 - 9. Barricades, warning signs and lights.
 - 10. Enclosure fence.
 - 11. Security enclosure and lockup.
 - 12. Providing protection of existing windows, doors, walls, floors, ceilings, and other existing building features from construction related damage by means of enclosures, chutes, plywood, mats, and/or coverings as deemed necessary by Owner.
 - 13. Grading of site to channel standing water to storm sewer facilities.
 - 14. Pumping of standing water from the site.
 - 15. Dewatering of excavations.
 - 16. Temporary sewers and drainage.
 - 17. Fuel costs for temporary heat.
- H. The Mechanical Contractor is responsible for setup, operation, maintenance, and removal of equipment and fixtures required to provide the following temporary facilities as required in this specification:
 - 1. Temporary heat, ventilation, and humidity control.
 - 2. Temporary water service.
 - 3. Temporary gas service.
- I. The Electrical Contractor is responsible for setup, operation, maintenance, and removal of:
 - 1. Temporary electrical service and distribution.
 - 2. Temporary lighting.
 - 3. Electrical power connection to temporary heating, ventilation, and other equipment provided by other contractors.

1.06 TEMPORARY UTILITIES

- A. Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
- B. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
- C. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
- D. Obtain easements to bring utilities to the site, where the Owner's easements cannot be used for that purpose.
- E. Cost or use charges for temporary facilities are not chargeable to the Owner or Architect; Prime Contractor's cost or use charges for temporary services or facilities will not be accepted as a basis of claim for an adjustment in the Contract Sum or Contract Time.

- F. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- G. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Sitework Divisions and Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- H. Water: Provide potable water approved by local health authorities.
 - 1. Water service and distribution: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 2. Sterilization: Sterilize temporary water piping prior to use.
 - 3. Water supply may only be interrupted on a weekend for changing over to the new service.
- I. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
 - 1. Connect temporary sewers to the municipal system as directed by the sewer department officials.
 - 2. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
 - 3. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 4. Temporary holding tanks and pumps will be required for both storm and sanitary sewer where existing services exit the present building in to the construction zone.
- J. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- K. Temporary Heat:
 - 1. Provide temporary heat required by construction activities, for curing or drying of completed installations, or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
 - 2. Temporary heat shall not be directly fired into the space, or have exhaust gases discharged into the tempered space. The contractor providing temporary heating facilities shall be responsible for complying with all workplace health requirements. Use of gasoline-burning space heaters, or open burning or salamander type heating units is prohibited.
- L. Heating Facilities: Provide properly vented self-contained LP gas or fuel oil heaters with individual space thermostatic control. Combustion gases shall be vented to the exterior. The permanent system shall not be used for temporary heat.
- M. Temporary Electric Power:
 - 1. Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 - 2. Power panels shall be 100A, 120/240V loadcenter or panelboards with NEMA AB1 type molded case circuit breakers. Panelboards shall be provided for use by all trades. Receptacles shall be equivalent to those specified in Division 26 Sections. Provide properly configured NEMA polarized

outlets to prevent insertion of 125 volt AC plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment. Power receptacles shall include three duplex 20A, 125V, single phase, and one 50A 125/250V, single phase located on a plywood backboard with the temporary panel. Receptacles shall be provided at intervals and locations as required for legal use of extension cords.

N. Temporary Electric Lights:

1. Whenever an overhead floor or roof deck has been installed, install temporary lighting with local switching.
2. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire lighting system, and will provide adequate illumination for construction operations and traffic conditions.
3. Contractor shall provide and maintain the equivalent illumination of one 100 watt incandescent fixture per 150 square feet of space (minimum one), as strings of lighting with guards, the full length of each corridor or interior construction route, and floodlighting for all exterior excavation areas. Every other stringer fixture and floodlighting shall be circuited and controlled by circuit breakers located in temporary power panels.
4. Lamps and Light Fixtures: Provide rough service lamps. Provide guard cages or tempered glass enclosures. Provide weatherproof quartz exterior fixtures.
5. Under no conditions shall the permanent lighting fixtures be used for temporary lighting, unless approved in writing obtained from the Architect/Engineer upon consultation with the Owner.

O. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

P. Existing facilities may not be used.

1.07 TELECOMMUNICATIONS SERVICES

- A. Each Contractor is responsible for their own cellular phone service.
- B. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.08 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.
- D. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Projects's needs.
- E. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility.

1.09 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public, of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- D. Provide protection for plants designated to remain. Replace damaged plants.
- E. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.10 FENCING

- A. Site Fencing:
 - 1. Construction: Commercial grade chain link fence.
 - 2. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.
- B. Tree Protection Fencing
 - 1. Provide 4 foot high orange polypropylene fencing located at the canopy line / drip line of trees on the site to protect trunks from damage and soil compaction around the root area.
 - 2. Posts are contractor's option
- C. Maintain the fences in good secure condition for the project's duration until agreement with the Owner and Architect that it may be removed.

1.11 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- B. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hours a day basis where required to achieve indicated results and to avoid possibility of damage.

1.12 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - 1. Insulated to R 12 (RSI 2.1).
 - 2. STC rating of 35 in accordance with ASTM E90.
 - 3. Maximum flame spread rating of 25 in accordance with ASTM E84.
 - 4. Interior protection barriers and walls shall be constructed using 5/8" type X gypsum board each side of 3-5/8 inch minimum thickness metal stud framing.
 - 5. Doors between construction and occupied spaces shall be self closing, and self latching.

1.13 SECURITY AND SAFETY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.
- C. First Aid Supplies: Comply with regulation of authorities having jurisdiction.
- D. Temporary Fire Protection

1. Fire Extinguishers: Provide hand-carried, portable, UL-rated, class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, class ABC dry chemical extinguishers, or a combination of extinguishers of NFPA recommended types for the exposures.
 2. Comply with NFPA 10 and 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
 3. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 4. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
- E. Store combustible materials in containers in fire-safe locations. Remove from construction site daily.
 - F. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - G. Provide continuous supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
 - H. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.
 - I. Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar materials so finishes will be undamaged at the time of acceptance.

1.14 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Designated existing on-site roads may be used for construction traffic.
- F. Coordinate temporary parking areas to accommodate construction personnel with Owner. When site space is not adequate, provide additional off-site parking.

1.15 WASTE REMOVAL

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- F. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when

the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste.

1.16 PROJECT SIGNS - SEE SECTION 01 5813

1.17 FIELD OFFICES

- A. Maintain field offices and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities under conditions acceptable to the Owner.
- B. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture .
- C. Provide space for Project meetings, with table and chairs to accommodate 12 persons.
- D. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Termination and Removal: Unless the Architect requests it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, but no later than Substantial Completion. Complete, or if necessary restore, permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace Work which cannot be satisfactorily repaired.
- E. Materials and facilities that constitute temporary facilities are property of each prime Contractor.
- F. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - 1. Replace air filters and clean inside of ductworks and housings.
 - 2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 - 3. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.
- G. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5813 - TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign.

1.02 QUALITY ASSURANCE

- A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.
- B. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
- C. Sign Media: Sintra PVC foam board or approved equal product.

2.02 PROJECT IDENTIFICATION SIGN

- A. One printed sign of construction, design, and content shown on Drawings, location designated.
- B. Size: 8 feet high by 12 feet wide.
- C. Graphics for the sign will be provided in electronic format by the Architect. Contractor shall have the graphic printed on the specified sign media.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at location coordinated with Architect.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

- A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

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 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.

1.05 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.

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. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.
 - 6. 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.scs-certified.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. Cass County Government 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 Cass County Government.
- 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 Cass County Government 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.
- E. Section 07 8400 - Firestopping.

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 Cass County Government 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. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- C. 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 Cass County Government occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Cass County Government'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 Cass County Government'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 Cass County Government'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 Cass County Government-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 Cass County Government.

END OF SECTION

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Cass County Government 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. 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.
- E. 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 Cass County Government.
- B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- E. 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 - NOT USED

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 Cass County Government, 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 Cass County Government'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 Cass County Government.
 - 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 Cass County Government'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 Cass County Government'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 Cass County Government.
- 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 Cass County Government.
- 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 Cass County Government.
- 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 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Joint devices associated with concrete work.
- B. Miscellaneous concrete elements, including equipment pads.
- C. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code for Structural Concrete—Code Requirements and Commentary; 2025.
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- G. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
- I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2024.
- J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2017a.
- K. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- M. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- N. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- O. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
- P. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- Q. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2023.
- R. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- S. ASTM D2103 - Standard Specification for Polyethylene Film; 2023a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- C. Mix Design: Submit proposed concrete mix design.
 1. Employ an independent testing laboratory to test proposed aggregate and design concrete mixes for each type of concrete required.
 2. Submit aggregate test reports and mix designs for approval 14 days prior to placing concrete.
 3. Test each type of fine and coarse aggregate for conformance to ASTM C33-78.
 4. Design mixes in accordance with ACI 301, Section 3.8.2, Method 1 or Method 2.
 5. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
- D. Test Reports: Submit report for each test or series of tests specified.
- E. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- F. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I/II Portland type, unless noted otherwise in Structural Drawings.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- E. Structural Fiber Reinforcement: ASTM C1116/C1116M.

2.02 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.03 ACCESSORY MATERIALS

- A. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
 1. Grout: Comply with ASTM C1107/C1107M.
 2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch (13.7 MPa).
 3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa).

2.04 CURING MATERIALS

- A. Curing and Sealing Compound, Low Gloss (CSLR-1): Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
 1. Apply in accordance with manufacturer's instructions during concrete curing.

2. Near Substantial Completion, apply a final coat(s) to produce a consistent, uniform low gloss finish to floor areas indicated to receive (CSLR-1).
3. Solids by Mass: 25 percent, minimum.
4. Products:
 - a. Dayton Superior Corporation; Cure & Seal 1315 J22WB: www.daytonsuperior.com.
 - b. TCC Materials; Tenon Cure & Seal WB 1315: www.tccmaterials.com.
 - c. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com.
 - d. BASF; Kure 1315: www.buildingsystems.basf.com.
 - e. Scofield; Cureseal-W: www.scofield.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Moisture-Retaining Sheet: ASTM C171.
 1. Curing paper, regular.
 2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).
- C. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch (0.102 mm) thick, clear.
- D. Water: Potable, not detrimental to concrete.

2.05 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- B. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
- C. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cu m), or as recommended by manufacturer for specific project conditions.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Notify Architect not less than 24 hours prior to commencement of placement operations.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.04 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
 - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.
- E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
 - 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 - 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
 - 4. Under Wood Athletic Flooring: 1/8 inch (3.2 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

- A. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal, unless noted otherwise in the drawings.

3.07 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.09 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- D. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2025.
- E. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
- F. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- G. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.
- H. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.
- I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.
- M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- O. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- P. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.
- Q. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013, with Editorial Revision (2014).
- R. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.
- S. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.
- T. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- U. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

- V. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- W. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- X. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- 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. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
 - 2. Special Shapes: Provide nonstandard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block.
 - 4. Nonloadbearing Units: ASTM C129.
 - a. Hollow block.
 - 5. Patterns and Faces:
 - a. (CMU-1): Manufacturer's standard color and texture.
 - b. Supplier of prefinished or integrally colors units shall guarantee that the finished product will not be stained or damaged due to iron or shale deposits in the face for a period of 5 years.
 - 6. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at time of manufacture.
 - a. Application: Provide integral water repellent in units exposed to the exterior.
 - b. Performance of Units with Integral Water Repellent:
 - 1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
 - (a) No water visible on back of wall above flashing at the end of 24 hours.
 - (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
 - (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
 - 2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
 - 3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
 - c. Use only in combination with mortar that also has integral water repellent admixture.

- d. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 BRICK UNITS

- A. Facing Brick (BRK-1): ASTM C216, Type FBS Smooth, Grade SW.
 - 1. Basis of Design: Garnet Smooth by Hebron Brick Company: www.hebronbrick.com.
 - 2. Nominal size: Utility.
 - 3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.03 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type S.
- B. Portland Cement: ASTM C150/C150M, Type I.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
 - 1. Use only in combination with masonry units manufactured with integral water repellent admixture.
 - 2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
 - 3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Basis of Design: Hohmann & Barnard, Inc; www.h-b.com.
- B. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - 1. Blok-Lok Limited: www.blok-lok.com.
 - 2. WIRE-BOND www.wirebond.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 Mpa), deformed billet bars. ASTM A706 Grade 60, where welding of rebar is required.
- D. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- E. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Ladder.
 - 2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
 - 3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.
- F. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Truss, with adjustable ties or tabs spaced at 16 in (406 mm) on center.
 - 2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
 - 3. Vertical adjustment: Not more than 1 1/4 inches (32 mm).

4. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.
- G. Brick Ties (BRICK TIE): Provide brick ties listed below at applicable locations. Where no appropriate brick tie is specified for a specific application, coordinate selection with Architect.
- H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

2.05 FLASHINGS

- A. Membrane Asphaltic Flashing Materials (TWF-1):
 1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet, laminated to stainless steel drip; 40 mils (0.040 inch) (1.0 mm) minimum total thickness; 8 mil (0.20 mm) cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner. Provide stainless steel termination bar over flashing, fastened at 16 inches on center.
 - a. Basis of Design: York Manufacturing, Inc; York Seal: www.yorkmfg.com.
 - b. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - 1) Advanced Building Products, Inc; Strip-N-Flash: www.advancedbuildingproducts.com.
 - 2) Carlisle Coatings & Waterproofing; Product CCW-705-TWF: www.carlisleccw.com.
 - 3) W.R. Grace; Product Perm-A-Barrier Wall Flashing.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- B. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- C. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
- D. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

- A. Preformed Control Joints (CJ-1): Rubber material. Provide with corner and tee accessories, fused joints.
- B. Cavity Mortar Control (MAS ACC-5): Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers:
 - 1) Advanced Building Products Inc; Mortar Break: www.advancedbuildingproducts.com/#sle.
 - 2) Mortar Net Solutions: www.mortarnet.com.
 - 3) York Manufacturing, Inc; Weep-Net: www.yorkflashing.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- C. Weeps and Vents (WEEP-1):
 1. Type: Polyester mesh.
 2. Color(s): As selected by Architect from manufacturer's full range.
 3. Basis of Design: Hohmann & Barnard, Inc; Mortar Trap Weep Vents: www.h-b.com.

4. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Multicomponent Cavity Wall Drainage System: Combination mortar diverter, flashing and weep system.
 1. Contractor's option to provide a multicomponent system in lieu of, or in addition to, individual components (TWF-1), (WEEP-1), and (MAS ACC-5) as specified herein.
 2. Membrane Type: Rubberized asphalt.
 3. Drip Edge: Stainless steel.
 4. Termination Bar: Stainless steel
 5. System Unit Length: 50 feet (15.24 m).
 6. Manufacturers:
 - a. Mortar Net Solutions: www.mortarnet.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
 1. Acceptable Products: Contractor's option to achieve the specified results without damage to masonry or surrounding materials, such as Sure Klean by Prosoco or other product with similar properties.
 2. Use in strict accordance with manufacturer's written instructions.

2.07 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 1. Bond: Running.
 2. Mortar Joints: Concave.
- D. Brick Units:

1. Bond: 1/3 Running.
2. Mortar Joints: Concave.

3.04 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Isolate masonry partitions from vertical structural framing members with a control joint.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.06 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.07 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 36 inches (900 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.09 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 1 inch (25.4 mm), minimum, to form watertight pan at non-masonry construction.
 2. Remove or cover protrusions or sharp edges that could puncture flashings.

3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Terminate flashing up 8 inches (203 mm) minimum on vertical surface of backing:
 1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.
 2. Anchor vertical leg of flashing into backing with a termination bar and sealant.
- C. Extend membrane flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
- D. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.10 LINTELS

- A. Install loose steel lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 1. Openings over 48 inches not scheduled: Contact Structural Engineer.

3.11 GROUTED COMPONENTS

- A. Follow lap splice requirements as indicated in Structural drawings.

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.13 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.14 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.
- C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.15 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

3.16 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- 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. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).
- K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
- M. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500 Grade C structural tubing.

- C. Plates: ASTM A36.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, Lintels and Plates not Attached to Structural Framing: For support of metal decking and masonry; galvanized finish.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Miscellaneous framing and sheathing.
- C. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. 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; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- D. ITS (DIR) - Directory of Listed Products; current edition.
- 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) - Standard Grading Rules; 2021.
- I. UL (DIR) - Online Certifications Directory; Current Edition.

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 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.

2.04 FIRE-RETARDANT TREATMENT (FRT)

- A. Products:
 - 1. Arxada; Dricon FS: www.arxada.com/#sle.
 - 2. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
 - 3. Koppers, Inc: www.koppersperformancechemicals.com/#sle.
 - 4. T2EARTH, LLC; OnWood: www.t2earth.com/#sle.
 - 5. UFP Industries; ProWood FR Lumber: www.ufpi.com/#sle.
 - 6. Viance, LLC; D-Blaze: www.treatedwood.com/#sle.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Factory-treat wood members in accordance with AWWA U1 and use category indicated.
- C. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.
- D. Fabrication of FRT Wood:
 - 1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
 - 2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
 - 3. Field cutting and drilling of holes in plywood are permitted.
- E. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

2.05 ACCESSORIES

- A. Metal and Finish of Fasteners:
 - 1. High Humidity Wood Locations: Hot-dip galvanized steel complying with ASTM A153/A153M.
 - 2. Untreated Wood: Unfinished steel.

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.

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. Wood casework with laminate cladding.
- B. Cabinet and drawer hardware.

1.02 RELATED REQUIREMENTS

- A. Section 12 3600 - Countertops.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's published, product descriptive data.
 - 1. Panel Cores for Wood Veneer, HPDL, and TFL Panels: For each type, include thickness.
 - 2. HPDL Laminates: For each type, indicate description, thickness, and color.
 - 3. Laminate Edgebanding: For each type, indicate material, thickness, and color.
 - 4. Hardware: For each type of cabinet and drawer hardware.
 - 5. Locks: For each type of cabinet and drawer lock.
- C. Shop Drawings:
 - 1. General: Each sheet sequentially numbered and dated.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: AWI QCP-licensed woodworking firm.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver products in original packaging materials bearing product identification.
- C. Store products prior to installation on flat, level, clean surfaces; elevate products above floors and protect from sunlight.
- D. Store non-wood-based products under cover and elevated above grade.
 - 1. Protect from excessive moisture and standing water.
- E. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.06 FIELD CONDITIONS

- A. Ambient Conditions for Acclimation, Installation, and Post-Installation of Wood-Based Products:
 - 1. Acclimation Period Prior to Installation: 72 hours minimum, inside installation environment.
 - 2. Temperature Conditions During Installation and Post-Installation: Maintain temperature between 60 degrees F (16 degrees C) and 90 degrees F (32 degrees C).
 - 3. Relative Humidity Conditions During Acclimation, Installation, and Post-Installation: Maintain relative humidity between 25 and 45 percent.
 - 4. Maximum Sustained Time outside Specified Relative Humidity Range: 24 hours.

PART 2 PRODUCTS

2.01 ARCHITECTURAL WOOD CASEWORK

- A. Casework Finish (PLAM-#): Wood casework with laminate cladding.

- B. Provide casework and casework components in sizes and profiles as indicated on drawings.
- C. Scribed Fillers:
 - 1. Finish and Materials: Same materials and finish as exposed surfaces.
 - 2. Material thickness: Comply with specified performance requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Architectural Woodwork Institute (AWI) Performance Requirements:
 - 1. Comply with AWI 300, ANSI/AWI 0641, ANSI/AWI 0400, and ANSI/AWI 0620 as applicable for specified casework finish, aesthetic grade, and performance duty level.
 - a. Aesthetic Grade: Custom.
 - b. Product Performance Duty Level: Duty Level 3.
 - 2. Panel and Material Thicknesses: Provide panels and materials as required to meet specified performance duty level, subject to minimum thickness requirements of AWI 300 and ANSI/AWI 0641 and flatness requirements indicated below.
 - 3. Panel Flatness: Provide panels with maximum variation from flat in 12 inches (300 mm) as measured diagonally across panel.
 - 4. Cabinet Door Flatness:
 - a. Comply with specified performance requirements.

2.03 WOOD CASEWORK WITH LAMINATE CLADDING

- A. Casework Construction:
 - 1. Frameless Cabinet and Door Interface: Flush overlay.
- B. Custom Grade - Laminate-Clad Wood Casework:
 - 1. Exposed Exterior Surfaces, Panels to Receive Laminate Cladding:
 - a. Comply with specified performance requirements.
 - 2. Exposed Interior Surfaces at Door and Drawer Fronts:
 - a. Comply with specified performance requirements.
 - 3. Exposed Interior Surfaces Except Door and Drawer Front Surfaces:
 - a. Comply with specified performance requirements.
 - 4. Semi-Exposed Surfaces; Panels to Receive Laminate Cladding:
 - a. Comply with specified performance requirements.
- C. Edgebanding Applications for Laminate-Clad Wood Casework:
 - 1. Drawer Box Top Edges:
 - a. Visible Cores: Provide edgebanding to match drawer side.
- D. Edgebanding Materials for Laminate-Clad Wood Casework:
 - 1. Thickness: 0.12 inch (3.0 mm).
 - 2. PVC: Well-matched to exposed face; radiused and beveled on edges and corners if thickness is greater than 0.039 inch (1.0 mm).

2.04 EDGE TREATMENT APPLICATIONS

- A. Front Edges of Frameless Cabinets:
 - 1. Provide edgebanding.
- B. Top Edges of Cabinets:
 - 1. Provide edgebanding at top edges of cabinets less than 80 inches (2030 mm) above floor, or when top edges are visible from above.
- C. Bottom Edges of Wall Cabinet Ends and Light Valances:

- D. Hinged Door Edges
 - 1. Provide edgebanding on all four edges except for solid wood doors.
- E. Drawer Front and Drawer False Front Edges:
 - 1. Provide edgebanding on all four edges except for solid wood drawers.

2.05 CONCEALED CABINET BASE COMPONENTS

- A. Cabinet Base Toe-Kick Subfronts:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.
- B. Cabinet Base Blocking and Stretchers:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.
- C. Cabinet Base Sleepers:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.

2.06 WOOD AND WOOD-BASED MATERIALS

- A. AWI 200 Wood Moisture Content Requirements:
 - 1. Climate Zone 2: Between 6 and 10 percent.
- B. AWI 300 General Requirements for Wood.
 - 1. Provide wood in accordance with AWI 300.

2.07 CABINET AND DRAWER HARDWARE

- A. Hinges, Number of Hinges for Each Cabinet Door:
 - 1. Door Heights Under 48 inches (1200 mm): Not less than two hinges per door.
 - 2. Door Heights Between 48 inches (1200 mm) and 84 inches (2100 mm): Not less than three hinges per door.
 - 3. Door Heights Greater than 84 inches (2100 mm): Not less than four hinges per door.
- B. Hinges, Self-Closing, Integrated Damper Hinges:
 - 1. Description: Self-closing hinges with integrated damper mechanisms.
 - 2. Features: Provide soft-closing integrated damper hinges.
 - 3. Material and Finish: Satin anodized aluminum.
- C. Cabinet Door Pulls:
 - 1. Description: Back-mounted pulls.
 - 2. Provide one pull for each drawer 24 inches (610 mm) or less in width.
 - 3. Provide two pulls for each drawer over 24 inches (610 mm) in width.
 - 4. Design: U-shape wire pulls.
- D. Adjustable Shelf Support Systems, Standards and Shelf Rests:
 - 1. Description: Slotted vertical standards with shelf rests for supporting shelves; standards mounted in evenly spaced, cleanly bored holes.
 - 2. Load Capacity: 300 lb (136 kg) minimum, per pair of standards and brackets.
 - 3. Adjustment Increment: 1-1/4 inches (32 mm).
 - 4. Material and Finish: Satin stainless steel.
- E. Drawer Slides: Provide at each drawer.
 - 1. Description: Hardware units that suspend drawers and provide controlled drawer sliding.
 - 2. Features: Soft-closing.
 - 3. Travel: Full extension with overtravel.
 - 4. Material and Finish: Satin anodized aluminum.
 - 5. Products:

- a. Accuride International, Inc: www accuride.com/#sle.
 - b. Grass America Inc: www.grassusa.com/#sle.
 - c. Hettich America, LP: www.hettich.com/#sle.
 - d. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com/#sle.
- F. Cabinet Door and Drawer Silencers:
- 1. Description: Self-adhesive rubber silencers.
 - 2. Doors, Quantity: One silencer at top and bottom of closing edge of each door.
 - 3. Drawers, Quantity: One silencer at back side of each drawer front cover.
 - 4. Size: 1/4 inch (6.4 mm) diameter; 1/8 inch (3.2 mm) projection.
- G. Cabinet Door Keyed Locks with Latch Bolts:
- 1. Description: Keyed locks for securing cabinet doors.

2.08 CASEWORK ACCESSORY COMPONENTS

- A. Counter Grommets: Plastic, with matching slotted caps; round.
- 1. Locations: Field installed.
 - 2. Shape: Round.
 - 3. Inside Diameter: 1-1/2 inches (38 mm).
 - 4. Color: Black.
- B. Trash Grommets: Stainless Steel.
- 1. Locations: Field Installed.
 - 2. Diameter: 6 inches

2.09 ACCESSORIES

- A. Fasteners: Size and type to suit application.
- B. 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.

2.10 FABRICATION

- A. Shop-fabricate casework to dimensions, profiles, and details indicated on drawings.
- B. Fabricate to maximum extents plausible, including doors, drawers, and hardware; fabricate units in sizes transportable through building openings.
- C. Wood Casework with Laminate Cladding: Apply laminates in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
- D. Provide cutouts for plumbing fixtures; verify locations of cutouts from on-site dimensions. Sand and seal cut edges.
- E. Edgebanding: Apply where specified; do not use more than one piece for any single length.
- F. Hardware: Install hardware in accordance with hardware manufacturer's written instructions; use fasteners supplied by hardware manufacturer.
- G. Fabrication Tolerances: Comply with specified performance requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify casework and materials required for installation have been delivered, handled and stored as specified.
- B. Verify wood blocking that provides casework backing is installed as indicated on drawings.

- C. Verify location and sizes of rough-in plumbing and rough-in electrical associated with work of this section.

3.02 PREPARATION

- A. Acclimate casework to environments indicated for installation.

3.03 INSTALLATION

- A. Install and secure work of this section in accordance with specified performance requirements.
- B. Install work of this section rigid, plumb, and level and in accordance with fabricator's documented instructions; secure casework as indicated on drawings.
 - 1. Align and secure adjoining cabinet units with fasteners in concealed locations.
- C. Install cabinet hardware in accordance with hardware manufacturer's documented instructions using hardware manufacturer's furnished fasteners.
- D. Install scribe fillers to close gaps between casework and adjacent walls.

3.04 TOLERANCES

- A. Comply with specified performance requirements for tolerances.

3.05 ADJUSTING

- A. Adjust hardware for smooth operation in accordance with hardware manufacturer's documented instructions.

3.06 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed surfaces of casework, shelving, and hardware.

3.07 PROTECTION

- A. Protect installed casework from subsequent construction operations.

END OF SECTION

SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at cavity wall construction.

1.02 RELATED REQUIREMENTS

- A. Section 07 2700 - Air Barriers: Separate air barrier materials.
- B. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

- A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2024.
- F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - a. (INSUL-2): Type IV, 25 psi.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.

5. Board Edges: Square.
6. Basis of Design: Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
7. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Air Barriers: See Section 07 2700.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Appropriate for purpose intended.
- D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.

1.02 REFERENCE STANDARDS

- A. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, and preparation requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

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

1.05 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Foamed-In-Place Insulation (INSUL-36): Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 2. Products:
 - a. BASF Corporation; WALLTITE US: www.spf.basf.com/#sle.
 - b. Enverge; NexSeal: www.envergesprayfoam.com.
 - c. Henry, a Carlisle Company; PERMAX 2.0: www.henry.com/#sle.
 - d. Johns Manville; JM IV HFO Closed-cell: www.jm.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete before insulation application.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Patch damaged areas.
- D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2700 - AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air barriers.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

1.03 DEFINITIONS

- A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- F. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).
- G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

- A. (AIR BAR-3): Contractor's option to provide a self-adhesive or liquid applied membrane as described in the following paragraphs.
 - 1. Air Barrier Sheet, Self-Adhered (AIR BAR-3):
 - a. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

- b. Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F (23 degrees C).
 - c. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
 - d. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.
 - e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
 - f. Comply with NFPA 285 requirements for wall assembly.
 - g. Seam and Perimeter Tape: As recommended by sheet manufacturer.
 - h. Basis of Design: Henry, a Carlisle Company; Blueskin VP160: www.henry.com.
 - i. Other Acceptable Products provided they meet or exceed the Basis of Design performance, including:
 - 1) GCP Applied Technologies; Perm-A-Barrier VPS 30: www.gcpat.com.
 - 2) VaproShield, LLC; WrapShield SA - Self-Adhered: www.vaproshield.com.
 - 3) W. R. Meadows, Inc; Air-Shield SMP: www.wrmeadows.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
2. Air Barrier, Fluid Applied (AIR BAR-3): Vapor semi-permeable, elastomeric waterproofing.
- a. Air Barrier Coating:
 - 1) Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
 - 2) Water Vapor Permeance: 11 perms (629 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F (23 degrees C).
 - 3) Elongation: 250 percent, minimum, when tested in accordance with ASTM D412.
 - 4) Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
 - 5) Comply with NFPA 285 requirements for wall assembly.
 - 6) Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - 7) Basis of Design: Henry, a Carlisle Company; Air-Bloc 17MR: www.henry.com/.
 - 8) Other Acceptable Products provided they meet or exceed the Basis of Design performance:
 - (a) GCP Applied Technologies; Perm-A-Barrier VPL 50RS UV Stable: www.gcpat.com.
 - (b) PROSOCO, Inc; R-GUARD Cat 5: www.prosoco.com/r-guard.
 - (c) W. R. Meadows, Inc; Air-Shield TMP: www.wrmeadows.com.
 - (d) Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
 - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
 - 2. All flashing materials shall be compatible with, and approved by, the membrane manufacturer.
 - 3. Comply with NFPA 285 requirements for wall assembly.

- C. Flexible Flashing: Self-adhering or mechanically-attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.
- D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Self-Adhered Sheets:
 - 1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
 - 2. Lap sheets shingle fashion to shed water and seal laps airtight.
 - 3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
 - 4. Use same material, or other material approved by sheet manufacturer, to seal to adjacent substrates, and as flashing.
 - 5. At wide joints, provide extra flexible membrane allowing joint movement.
- E. Openings and Penetrations in Exterior Air Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
 - 2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
 - 3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
 - 4. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air barrier to flashing.
 - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- C. Take digital photographs of each portion of installation prior to covering up air barriers.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.
- E. CDA A4050 - Copper in Architecture - Handbook; Current Edition.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 PREFINISHED ALUMINUM SHEETS

- A. Description (SMF-2): Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.
- B. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.
- C. Superior Performance Organic Coating System: Comply with AAMA 2605 for aluminum preparation, pretreatment, primer and finish coat system; provide thermally cured 70-percent PVDF fluoropolymer systems; tested for weathering for 10 years with 5 delta units color change maximum.
- D. Drawing Detail: As indicated on drawings.
- E. Base Metal Thickness: 0.032 inch (0.81 mm), minimum.
- F. Color: As selected by Architect from manufacturer's standard colors.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

- A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.

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; 2025b.
- 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 C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
- F. 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.
- C. Verify that backer rods are of the correct size.

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 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.
- G. 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.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- I. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- L. ITS (DIR) - Directory of Listed Products; current edition.
- M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- O. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- S. UL (DIR) - Online Certifications Directory; Current Edition.

- T. 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: 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.

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 MANUFACTURERS

- A. Hollow Metal Frames with Integral Casings:
 - 1. Basis of Design: Steelcraft, an Allegion brand: www.allegion.com.
 - 2. 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. The Dunbarton Group; Redi-Frame: <http://dunbarton.com>.
 - 2. IDP - International Door Products Corp: www.idpframes.com.
 - 3. Timely Industries, Inc: www.timelyframes.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 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 (galvannealed) 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.

2.03 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: 16 gauge, 0.053 inch (1.3 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: 16 gauge, 0.053 inch (1.3 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.

2.04 FINISHES

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

2.05 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 1213 - Hollow Metal 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. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Warranty, executed in Cass County Government'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 Cass County'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 MANUFACTURERS

- A. Wood Veneer Faced Doors:

1. Basis of Design: VT Industries: www.vtindustries.com.
2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. VT Industries, Inc: www.vtindustries.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 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.

2.03 DOOR AND PANEL CORES

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

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red 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.

2.05 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.

2.06 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: Ravine, RA18.
 - c. Sheen: Satin.
- B. Seal door top edge with color sealer to match door facing.

2.07 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 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Field paint finish.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.

PART 2 PRODUCTS

2.01 WALL- AND CEILING-MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. ACUDOR Products Inc: www.acudor.com.
 - 2. Babcock-Davis: www.babcockdavis.com.
 - 3. Cendrex, Inc: www.cendrex.com.
 - 4. Karp Associates, Inc: www.karpinc.com.
 - 5. Nystrom, Inc; HVAC - Access Doors: www.nystrom.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Door and Frameless Units (ACC PNL-1): Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
 - 1. Style: Exposed frame with door surface flush with frame surface.
 - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
 - 2. Door Style: Single thickness with rolled or turned in edges.
 - 3. Frames: 16-gauge, 0.0598-inch (1.52 mm) minimum thickness.
 - 4. Single Steel Sheet Door Panels: 16-gauge, 0.0625-inch (1.6 mm) minimum thickness.
 - 5. Size: As scheduled above unless otherwise indicated in the drawings.
 - 6. Hardware:
 - a. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
 - b. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.

- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 3400 - SLIDING DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:
 - 1. Interior Aluminum-Framed Top-Hung Sliding Doors
- B. Related Sections:
 - 1. Section 08 1416 - Flush Wood Door

1.03 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. ANSI 156.18 Materials and Finishes
 - 2. ANSI A117.1 Specifications for making buildings and facilities usable by physically handicapped people.
- B. BHMA - Builders Hardware Manufacturers Association
- C. DHI - Door and Hardware Institute
- D. NFPA - National Fire Protection Association
 - 1. NFPA 80 - Fire Doors and Windows
 - 2. NFPA 101 - Life Safety code
 - 3. NFPA 105 - Smoke and Draft Control Door Assemblies
 - 4. NFPA 252 - Fire Tests of Doors Assemblies
- E. AWS - Architectural Woodwork Standards

1.04 SUBMITTALS

- A. Comply with Section 01 3000 - Administrative Requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show required blocking by others.
- D. Samples: Submit manufacturer's samples of the following sliding door components:
 - 1. Door veneer or laminate sample.
 - 2. Aluminum Frame finish sample.
- E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- F. Warranty Documentation: Submit manufacturer's standard warranty.
- G. Test Reports: Submit acoustical reports or UL1784 as applicable.

1.05 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and doors.
- B. Source: Obtain sliding aluminum framed doors and hardware from single source.

- C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

1.06 PERFORMANCE

- A. Aluminum perimeter frames with integral acoustic seals.
- B. Soft self-closing mechanism integrated with top track.
- C. Concealed door guide.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Notify manufacturer immediately of any shipping damage.
- C. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
 - 3. Store materials in clean, dry area indoors.
 - 4. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. AD Systems: <http://specadsystems.com>.
- B. Serenity Sliding Door Systems: <https://serenityslidingdoor.com>.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 INTERIOR SLIDING ALUMINUM-FRAMED DOORS AND PARTITIONS

- A. Basis of Design: ExamSlide Barn Door System by AD Systems.
- B. Frame Profiles: Extruded aluminum frame "wrap" frame with integral vertical jamb (stile pocket).
- C. Finish:
 - 1. Standard: Painted Hardcoat (Kynar) Finish. Meets AAMA 2604 Standard Colors: Match clear anodized.
- D. Door Leafs. All Doors to be factory machined for hardware including pilot and function holes.
 - 1. 1-3/4" Flush Wood Door: See Section 08 1416 Flush Wood Doors or other section as applicable.
 - 2. Aluminum Stile & Rail Door: Manufacturer's standard 1-3/4 inch thick glazed doors with extruded-aluminum tubular stile and rail members. Welded and bolted corner connections.
 - a. 3-1/2 inch vertical stiles plus 1/2 inch stop.
 - b. 3-1/2 inch Horizontal stiles plus 1/2 inch stop
 - c. 10" bottom Rail.
 - d. Glazing: Monolithic clear tempered.
- E. Door Components:
 - 1. Single Top Track: Extruded aluminum track.
 - 2. Valances: Extruded aluminum with integral end caps
 - a. Standard clear anodized aluminum valance
 - 3. Top Rollers: tandem nylon roller sized to match door weight.
 - 4. Concealed Floor Guide: Integral Jamb floor guide.
 - 5. Soft-Closer: Soft and self-closing damper mechanism at both sides of door leaf.
 - 6. Pull Handles:

- a. AD Systems Standard Straight Pull: 12" long x 1" diameter. Finish: US32D Satin Stainless Steel.

2.03 ACCESSORIES

- A. Door Locks:
 - 1. Mortise Latch and Lock Options: See Section 08 7105 for function.
- B. Self-Closing Spring Mechanism: Provide at doors smoke or fire rated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.
- B. Verify dimensions of wall openings.
- C. Examine surfaces to receive top and bottom guide.
- D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors.
- E. Do not begin installation until unacceptable conditions are corrected.
- F. Base of door side to be flush or minimal. Rubber Base acceptable.

3.02 INSTALLATION

- A. Install sliding doors in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install sliding doors plumb, level, square, and in proper alignment.
- C. Install sliding doors to close against walls without gaps.
- D. Install sliding doors to open and close smoothly.
- E. Anchor sliding doors securely in place to supports. Required: Fire treated 2 x 6 blocking required full length of track.

3.03 ADJUSTING

- A. Adjust sliding doors for proper operation in accordance with manufacturer's instructions.
- B. Adjust sliding doors to operate smoothly without binding.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

3.04 CLEANING

- A. Clean sliding doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage materials or finish.

3.05 PROTECTION

- A. Protect installed sliding doors from damage during construction.

END OF SECTION

SECTION 08 4126 - GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. All-glass entrances.
- B. All-glass storefronts.
- C. Swinging doors.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 09 2116 - Gypsum Board Assemblies.

1.03 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.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in all-glass entrance assembly.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
 - 1. Include field measurements of openings.
 - 2. Include elevations showing:
 - a. Appearance of all-glass entrance layouts.
 - b. Locations and identification of manufacturer-supplied door hardware and fittings.
 - c. Locations and sizes of cut-outs and drilled holes for other door hardware.
 - 3. Include details of:
 - a. Requirements for support and bracing at openings.
 - b. Installation details.
 - c. Appearance of manufacturer-supplied door hardware and fittings.
 - 4. Schedule: Listing of each type component in all-glass entrance assemblies, cross-referenced to shop drawing plans, elevations, and details.
- D. Certificates: Contractor's certification that installer of entrance assemblies meets specified qualifications.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum three years of experience installing entrance assemblies similar to those specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. All-Glass Entrances and Storefronts:
 - 1. Avanti Systems USA: www.avantisystemsusa.com.
 - 2. C.R. Laurence Company, Inc: www.crl-arch.com.
 - 3. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fittings and Hardware:

2.02 ALL-GLASS ENTRANCES AND STOREFRONTS ASSEMBLIES

- A. Frameless Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of frameless glass panels fastened with metal structural fittings in configuration indicated on drawings.
 - 1. Basis of Design: Frameless CRL Cascade by C.R. Laurence Company, Inc. (ALCNL-1)
 - 2. Glass Thickness: 1/2 inch (12.7 mm).
 - a. Tempered.
 - b. Glass Distraction Markers as selected by Architect.
 - c. Sealants as selected by Architect.
 - 3. Finish: Satin Anodized
 - 4. Finished metal surfaces protected with strippable film.
 - 5. Factory assembled to greatest extent practicable; may be disassembled to accommodate shipping constraints.
 - 6. U-Channel Fittings: Extruded aluminum, dry glazed gaskets, and with matching end caps
 - a. Top channel: 1-1/2 inch (38 mm) high by 1 inch (25.4 mm) wide.
 - b. Bottom Channel: 1 inch (25.4 mm) high by 1 inch (25.4 mm) wide.
- B. Framed Glazed Interior Wall and Door Assembly: Factory fabricated assemblies consisting of frameless glass panels fastened with metal structural fittings in configuration indicated on drawings.
 - 1. Basis of Design: Fallbrook XL by C.R. Laurence Company, Inc. (ALFRM-2)
 - 2. STC Rating: 42
 - 3. Glass:
 - a. See (ACOUST GL-1) below.
 - b. Glass Distraction Markers as selected by Architect.
 - c. Sealants as selected by Architect.
 - 4. Operational Loads: Designed to withstand door operation under normal traffic without damage, racking, sagging, or deflection.
 - 5. Prepared for all specified hardware whether specified in this section or not.
 - 6. Finish: Satin Anodized
 - 7. Finished metal surfaces protected with strippable film.
 - 8. Factory assembled to greatest extent practicable; may be disassembled to accommodate shipping constraints.
 - 9. U-Channel Fittings: Extruded aluminum, dry glazed gaskets, and with matching end caps.
 - a. Ceiling Channel: 1-3/8 inch (35 mm) high by 1 11/16 inch (43 mm) wide.
 - b. Floor and Wall Channel: 1 inch (26 mm) high by 1 11/16 inch (43 mm) wide.
- C. Swinging Door Fittings and Hardware: (ALFRM-2)
 - 1. See Drawings for Configurations.
 - 2. Door profiles for pivoting glass doors: As selected by Architect.

3. Profile width: 2 1/16 inch (52mm) Fallbrook XL
4. Profile depth: 1 7/8 inch (48mm) Fallbrook XL
5. Glass thickness: 1/2 inch (12mm) Fallbrook XL
6. Finish: Satin anodized.
7. Provide accessories as required for complete installation.
8. Basis of Design: Catalog No. AH18 Architectural Hardware, 542Z-543Z.

2.03 FITTINGS AND HARDWARE

- A. Hinges, locks and handles, as required.

2.04 MATERIALS

- A. (ACOUST GL-1) Sound Control Glazing: Laminated double insulating glass.
 1. Applications: Locations as indicated on drawings.
 2. Tint: Clear.
 3. Sound Transmission Class (STC) Rating: Provide at least STC 42 rating, conforming to ASTM E90 and ASTM E413.
 4. Overall Thickness: As required to meet STC rating as indicated. 1 1/8 inch overall.
 5. Laminated Double Insulating Glass: 1 1/8 inch IG
 - a. Outer Layer, Outboard side: Tempered.
 - b. Inner Layer, Outboard side: Annealed
 - 1) 11/32 inch Laminated
 - c. Air Space: 1/2 inch (12.7 mm), filled with air.
 - d. Inner Layer, Inboard side: Annealed glass.
 - e. Outer Layer, Inboard side: Tempered.
 - 1) 9/32 inch Laminated
 - f. Interlayers: Polyvinyl butyral (PVB), 0.060 inches thick.
 - g. C.R. Laurence Company, Inc. Data File No. Q5612.0181
 6. Glazing Method: As required to meet STC rating as indicated.
- B. Aluminum Components: Comply with ASTM B221 (ASTM B221M), Alloy 6063, Temper T5.
- C. Sealant: One-part silicone sealant, comply with ASTM C920, clear.

2.05 ACCESSORIES

- A. Exposed Fittings and Hardware: Extruded aluminum, clear anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Installation of metal framing for openings as specified in Section 09 2116.

- B. Install in accordance with manufacturer's installation instructions.
- C. Tolerances:
 - 1. Horizontal Components and Sight Lines: Not more than 1/8 inch in 10 feet (3.2 mm in 3 m) variation from level, non-cumulative.
 - 2. Vertical Components and Sight Lines: Not more than 1/8 inch in 10 feet (3.2 mm in 3 m) variation from plumb, non-cumulative.
 - 3. Variation from Plane or Indicated Location: Not more than 1/16 inch (1.6 mm).

3.04 ADJUSTING

- A. Adjust doors to operate correctly, without binding to frame, sill, or adjacent doors.
- B. Adjust door hardware for smooth operation.

3.05 CLEANING

- A. Clean installed work to like-new condition.

3.06 PROTECTION

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

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.
- C. Weatherstripping.

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 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- I. 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. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- E. 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 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING (ALSTOR-1)

- A. Center-Set Style, Thermally-Broken:
 - 1. 2 inch by 4-1/2 inch, nominal frame profile.
 - a. Basis of Design: Kawneer Company, Inc; Trifab VersaGlaze 451T; www.kawneer.com.
 - b. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - 1) EFCO Corporation; Series 403 Storefront Framing; www.apogeeearchmetals.com.
 - 2) Oldcastle Building Envelope; Series 3000 Thermal MultiPlane; obe.com.
 - 3) Tubelite Inc; T14000 Series; www.apogeeearchmetals.com.
 - 4) YKK AP America Inc; YES 45 TU; www.ykkap.com.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (ALSTOR-2)

- 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 Storefront Framing; www.apogeeearchmetals.com.
 - 2) Oldcastle Building Envelope; FG-3000; obe.com.
 - 3) Tubelite Inc; E14000 Series; www.apogeeearch.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. Basis of Design: Kawneer Company, Inc; 500 Heavy Wall Entrances; www.kawneer.com.
 2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. EFCO Corporation; Series D518 DuraStile; www.apogeeearchmetals.com.
 - b. Oldcastle Building Envelope; Rugged Entrance Wide Stile Door and Frame; obe.com.
 - c. Tubelite Inc; Monumental Doors; www.apogeeearchmetals.com.
 - d. YKK AP America Inc; 50M Monumental Commercial Entrances; www.ykkap.com.
- B. Wide Stile, Insulating Glazing, Thermally-Broken:
 1. Basis of Design: Kawneer Company, Inc; 560 Insulclad Thermal Entrances; www.kawneer.com.
 2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. EFCO Corporation; Series D502 ThermaStile; www.apogeeearchmetals.com.
 - b. Oldcastle Building Envelope; WS-500TC Thermal Composite Door & Frame Entrances; obe.com.
 - c. Tubelite Inc; Therml=Block Entrances; www.apogeeearchmetals.com.
 - d. YKK AP America Inc; MegaTherm 50T Thermally Broken Entrance Systems; www.ykkap.com.

2.04 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing.
 2. Finish Color: Dark bronze; to match existing.
 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. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 6. 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.
 7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of applicable code.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf (480 Pa).
 3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
 4. Condensation Resistance Factor of Framing: 60, minimum, measured in accordance with AAMA 1503.
 5. Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F), maximum.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, 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. Sealant for Setting Thresholds: Non-curing butyl type.

- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- I. 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. For each door, include weatherstripping.
- B. Other Door Hardware: See Section 08 7100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Automatic Door Operators and Actuators: See Section 08 4229.

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 sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.
- J. 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, aluminum, and hollow metal doors.
- B. Electrically operated and controlled hardware.
- C. Thresholds.
- D. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 1416 - Flush Wood Doors.
- C. Section 08 7113 - Power Door Operators.

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 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
- M. UL (DIR) - Online Certifications Directory; Current Edition.
- N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- O. 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. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. 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.
- F. 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. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review, and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to insure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- F. Hardware supplier shall be factory trained and certified by the manufacturer to provide and support all computer managed locks and system components.
- G. 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.
- H. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- I. 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. Exit Devices: Three years, minimum.
 - 3. Locksets and Cylinders: Three years, minimum.
 - 4. 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. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- E. 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
- 2. Self Closing Hinges:
 - a. (0.134) Steel:
 - 1) Bommer: LB4310
 - 2) Hager: 1250
 - 3) McKinney: 1502
 - 4) Stanley: 2060R
 - 5) Ives: 3SP1
 - 6) PBB: RS81
 - b. (0.134) Stainless Steel:
 - 1) Bommer: LB4390
 - 2) Hager: 1150
 - 3) McKinney: 1552
 - 4) Stanley: 2060R
 - 5) Ives: 3SP1
 - 6) PBB: BB81
- 3. Continuous Hinges:
 - a. Edge Mount Pin & Barrel Stainless Steel:
 - 1) Ives: 700 Series
 - 2) Markar: 300 Series
 - 3) Stanley: 650 Series
 - 4) McKinney: 300 Series
- 4. Power Transfers:
 - a. Concealed Ten-Wire:
 - 1) Von Duprin: EPT-10
 - 2) ASSA: CEPT-10
- 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. Continuous Hinges: Comply with BHMA A156.26.
 - a. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 lbs. Edge mount (unless noted otherwise).
 - b. Construct hinges of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of 0.25 and the exterior barrel diameter of 0.438.
 - c. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.
 - d. Each knuckle to be 2 inch, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.

- e. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.
- f. Provide machine screws for doors which have been reinforced to accept machine screws.
- g. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.
- 3. Provide hinges on every swinging door.
- 4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
- 5. Provide non-removable pins on exterior outswinging doors.
- 6. Provide power transfer hinges where electrified hardware is mounted in door leaf.
 - a. Concealed power transfers shall be concealed in the door and frame when the door is closed.
 - b. Concealed power transfers shall have a steel tube to protect wires from being cut.
 - c. Concealed power transfers with spring tubes shall be rejected.
 - d. Concealed power transfers shall be supplied with a mud box to house all terminations.
- 7. 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.
- 8. Unless otherwise specified, furnish hinges in the following sizes:
 - a. 4-1/2" x 4-1/2" 1-3/4" thick doors
- 9. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
- 10. 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.
- 11. Unless otherwise specified, furnish all hinges to template standards.
- 12. 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.
- 13. 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 TRACK AND HANGERS

- A. Door Weight: Medium; medium frequency of use with 150 to 200 lbs door weight.

2.05 FLUSH BOLTS

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Dust Proof Strike:
 - a. Ives: DP2
 - b. Door Controls: 80
 - c. Hager: 280X
 - d. Rockwood: 570
 - 2. Constant Latch Flush Bolt:
 - a. Ives: FB51P/FB61P
 - b. Door Controls: 805/905
 - c. Hager: 293D/294D

- d. Rockwood: 2849/2949
- 3. Automatic Flush Bolt:
 - a. Ives: FB31P/FB41P
 - b. Door Controls: 842/942
 - c. Hager: 291D/292D
 - d. Rockwood: 2842/2942
- 4. Manual Flush Bolt:
 - a. Ives: FB548
 - b. Door Controls: 780
 - c. Hager: 282D
 - d. Rockwood: 555
- B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
 - 1. Flush Bolt Throw: 3/4 inch (19 mm), minimum.
 - 2. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
 - 3. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'-6" or less, 24" top rods for doors over 7'-6" to 8'-6".
 - 4. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.
 - 5. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.

2.06 EXIT DEVICES

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Wide Stile, Push Pad:
 - a. Von Duprin: 98/99 Series
 - b. Sargent: GL-43-80 Series
 - c. Detex: Advantex (Wide Stile)
 - 2. Wide Stile, Electric Latch Retraction:
 - a. Von Duprin: QEL 98/99 Series
 - b. Sargent: GL-43-56-80 Series
 - c. Detex: Advantex-ER (Wide Stile)
 - 3. Lever Trim/Pull Trim:
 - a. Von Duprin: 996/990 Series
 - b. Sargent: 740 ET/800 MAL
 - c. Detex: "D/DM" / "C" Trim
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
 - 1. Lever design to match lockset trim.
 - 2. Provide cylinder with cylinder dogging or locking trim.
 - 3. Provide exit devices properly sized for door width and height.
 - 4. Provide strike as recommended by manufacturer for application indicated.
 - 5. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
 - 6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
 - 7. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
 - 8. Provide a sound-dampening feature to reduce touch pad return noise.

9. Quiet Electric Latch Retraction shall be accomplished using a motor driven assembly, and shall incorporate the following features:
 - a. Motor shall retract both the push pad assembly and latchbolt.
 - b. Automatic calibration of latch throw and pull.
 - c. Built-in time delay.
 - d. On-board installation and troubleshooting diagnostics built into power supply and device.
 - e. Retry mode if device does not pull on the first try.
10. Provide flush end caps to reduce potential damage from impact.
11. Provide dead-locking latch bolts to ensure security.
12. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
13. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
14. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:
 - a. Fire Rated devices: Dogging not permitted.
 - b. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.
 - c. Non-Rated Classroom functions: Less Dogging.
 - d. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.
 - e. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders.
Cylinder keyway shall match locksets furnished on this project.
15. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
16. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
17. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.07 ELECTRIC STRIKES

- A. Acceptable manufacturers and respective catalog numbers:
 1. Von Duprin 6000 Series.
 2. HES 1006 Series.
- B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
 1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
 2. Provide non-handed (verify voltage with electrical contractor) electric strike suitable for door frame material and scheduled lock configuration.
 3. Provide transformer and rectifier as necessary for complete installation.

2.08 ELECTROMAGNETIC LOCKS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Schlage Electronics M490 Series.
 2. Securitron 82B.
- B. Electromagnetic Locks: Comply with BHMA A156.23, Grade 1.
 1. Holding Force: 1200 lbs (544 kgs), minimum.
 2. Provide electromagnetic locks for fire-rated doors in compliance with UL 10C.
 3. Mounting: Concealed (shear) mounted into door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.

4. Provide concealed sensing device within device that monitors magnetic holding force to ensure appropriate door lock.
5. Provide concealed adjustable time delay option to re-lock door, adjustable from 1 to 90 seconds.

2.09 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.

2.10 CYLINDRICAL LOCKS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Grade 1 Locks:
 - a. Schlage ND Series SPA
 - b. Sargent 10/11 Line LP
 - c. Corbin CL3100 PZD
 - d. Best 9K Series 14D
 2. Grade 2 Locks:
 - a. Schlage ALX Series SPA
 - b. Sargent 6500 Series
 - c. Corbin CL3800 Series
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1.
 1. Bored Hole: 2-1/8 inch (54 mm) diameter.
 2. Latchbolt Throw: 1/2 inch (12.7 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.

2.11 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.

2.12 AUXILIARY LOCKS (DEADLOCKS)

- A. Acceptable manufacturers and respective catalog numbers:
 1. Schlage B600 Series
 2. Sargent 480 Series
 3. Corbin DL3100 Series
 4. Best 83T Series
- B. Auxiliary Locks (Deadlocks): Comply with BHMA A156.36, Grade 1.
 1. Type: Bored (cylindrical).
 2. Application: Bored.
 3. Backset: 2-3/4 inch (70 mm), unless otherwise indicated.
 4. Bolt Throw: 1 inch (25 mm), with latch made of hardened steel.
 5. Provide strike that matches frame.

2.13 DOOR PULLS, PUSH PLATES AND PUSH BARS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Offset Door Pull (1" dia. 10" ctc):
 - a. Burns 39C
 - b. Hager 12J
 - c. Rockwood BF157
 - d. Ives 8190-0
 2. Offset Pull/Push Bar (1" dia. 10" ctc Pull):
 - a. Burns 422 x 39C
 - b. Hager 157
 - c. Rockwood BF15747
 - d. Ives 9190-0
 3. Pull Plate (0.050" 6" x 16"):
 - a. Burns 56
 - b. Hager 30S 6 x 16
 - c. Rockwood 70E
 - d. Ives 8200 6" x 16"
 4. Pull Plate (1" dia. 10" ctc - 0.050" x 4" x 16"):
 - a. Burns 5426C
 - b. Hager 34J 4 x 16
 - c. Rockwood 111 x 70C
 - d. Ives 8303-0 4" x 16"
- B. Door Pulls, Push Plates, and Push Bars: Complying with BHMA A156.6.
 1. Pull Type: Offset, unless otherwise indicated.

2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
3. Bar Type: Push bar, unless otherwise indicated.
4. Material: Aluminum, unless otherwise indicated.
5. Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.
6. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.14 COORDINATORS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Bar Coordinator:
 - a. Ives COR x FL
 - b. Door Controls 600 x Filler
 - c. Hager 297D x 297F
 - d. Rockwood 2600 Series
- B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
 1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Mounting Bracket: As required for application.
 4. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.15 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:
 1. LCN 4050/4050 EDA
 2. Norton R7500/PR75
 3. Sargent 351/351P10
 4. (above or below depending on project)
 5. LCN 4040XP/ 4040XP EDA
 6. Norton 9500 Series
 7. Sargent 281 Series
 8. Corbin DC8000 Series
- 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.

2.16 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
 2. Concealed Mount:
 - a. Glynn-Johnson GJ100 Series
 - b. Rixson 1 Series
 - c. Sargent 690
- 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.

2.17 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.

2.18 ELECTROMAGNETIC DOOR HOLDERS

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. LCN SEM 7800
 - 2. ABH 2000
 - 3. Edwards 1500
- B. Electromagnetic Door Holders: Comply with BHMA A156.15.
 - 1. Type: Wall mounted, single unit, standard duty, with strike plate attached to door.
 - 2. Holding Force, Standard Duty: 35 lbs-force (155 N), minimum.
 - 3. Fail safe; door released to close automatically when electrical current is interrupted.
 - 4. Housing and armature shall be constructed of a die cast zinc material.
 - 5. Provide types as listed in groups.
 - 6. Where wall conditions do not permit the armature to reach the magnet, provide extensions.
 - 7. Provide proper voltage and power consumption as required by Division 26.
 - 8. Coordinate electrical requirements and mounting locations with other trades.
 - 9. Provide interface with fire detectors and fire-alarm system for fire-rated door assemblies.

2.19 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
 - 2. Automatic Wall Holder:
 - a. Ives WS40
 - b. Hager 326W
 - c. Burns 533
 - d. Rockwood 490
- 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.

2.20 THRESHOLDS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Zero 8655
 2. Pemko 171
 3. National Guard Products 425
 4. Reese S205
- B. Thresholds: Comply with BHMA A156.21.
 1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Material: Aluminum.
 3. Threshold Surface: Fluted horizontal grooves across full width.
 4. Provide non-corroding fasteners at exterior locations.
 5. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.
 6. Threshold Types:
 - a. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
 - b. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.21 WEATHERSTRIPPING AND GASKETING

- A. Acceptable manufacturers and respective catalog numbers:
 1. Weatherstrip:
 - a. Zero 429
 - b. Pemko 2981_PK
 - c. National Guard Products 700NA
 - d. Reese 755
 2. Adhesive Gasket:
 - a. Zero 188S
 - b. Pemko S88
 - c. National Guard Products 5050
 - d. Reese 797
 3. Mullion Seal/Silencer
 - a. Zero 8780
 - b. Pemko 5110
 - c. National Guard Products 5100N
 4. Meeting Edge Seals:
 - a. Zero 8193
 - b. Pemko 18041
 - c. National Guard Products 9605
 - d. Reese 959

5. Automatic Door Bottom:
 - a. Zero 355
 - b. Pemko 42APKL
 - c. National Guard Products 320N
 - d. Reese 372A
6. Sweeps:
 - a. Zero 8192
 - b. Pemko 18061_NB
 - c. National Guard Products B606
 - d. Reese 964
7. Sweeps with Drip:
 - a. Zero 8198
 - b. Pemko 345_N
 - c. National Guard Products C627
 - d. Reese 354
8. Drip Cap:
 - a. Zero 142
 - b. Pemko 346
 - c. National Guard Products 16
 - d. Reese R201
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with brush weatherstripping.
 4. Provide gasketing (equal to Zero 188S) for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
 5. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 6. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.22 LATCH PROTECTOR

- A. Latch Protector: Provide on door to protect latch from being tampered with while in locked position.
 1. Type: Standard latch protector.
 2. Material: Stainless steel.

2.23 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.

2.24 KEY CABINET

- A. Acceptable manufacturers and respective catalog numbers:
 1. Lund 1200-1205 AA
 2. Key Control M228-2480
 3. Telkee RWC-AWC
- B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
 1. Mounting: Wall-mounted.
 2. Capacity: Actual quantity of keys, plus 50 percent additional capacity.
 3. Size key hooks to hold 6 keys each.
 4. Finish: Baked enamel, manufacturer's standard color.
 5. Key cabinet lock to building keying system.
 6. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.
 7. Hardware supplier shall prepare all key change index records, tag all keys and place permanent file keys in cabinet.

2.25 DOOR POSITION SWITCHES

- A. Acceptable manufacturers and respective catalog numbers:
 1. Schlage Electronics 679 Series
 2. Sentrol 1076W
 3. Sargent 3287

2.26 POWER SUPPLY

- A. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
 1. Operating Temperature: 32 to 110 degrees F (0 to 43 degrees C).
 2. 12/24 VDC Output, field selectable.
 3. Class 2 Rated power limited output.
 4. Universal 120-240 VAC input.
 5. Low voltage DC, regulated and filtered.
 6. Polarized connector for distribution boards.
 7. Fused primary input.
 8. AC input and DC output monitoring circuit w/LED indicators.
 9. Cover mounted AC Input indication.
 10. Tested and certified to meet UL294.
 11. NEMA 1 enclosure.
 12. Hinged cover w/lock down screws.
 13. High voltage protective cover.
 14. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings

connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.27 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).
 - b. Push Plates/Pull Bars: 42 inch (1067 mm).
 - c. Deadlocks (Deadbolts): 48 inch (1219 mm).
 - d. Exit Devices: 40-5/16 inch (1024 mm).
 - e. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).
- E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 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 1.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Passage Lockset	ND10S	SCH
1 EA	Wall Stop	WS406	IVE

Function:

Latch bolt by lever at all times.

HDWE GROUP 3.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Classroom Lockset	ND70	SCH
1 EA	Wall Stop	WS406	IVE

Function:

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

HDWE GROUP 3.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Classroom Lockset	ND70, with occupancy indicator	SCH
1 EA	Wall Stop	WS406	IVE

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	ND80	SCH
1 EA	Wall Stop	WS406	IVE

Function:

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

HDWE GROUP 4.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Constant latch flushbolt	FB51T/FB61T	IVE
1 EA	Storeroom Lock	ND80	SCH
2 EA	Overhead stop	90S	GLY

Function:

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

HDWE GROUP 5.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Entrance Lock	ND53	SCH
1	EA	Wall Stop	WS406	IVE

Function:

Turn/Push button locking; pushing and turning button locks outside lever requiring use of key until the button is manually unlocked. Push-button locking; pushing button locks outside lever until unlocked by key or by turning the inside lever.

HDWE GROUP 5.1

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Entrance Lock	ND53	SCH
1	EA	Wall Stop	WS406	IVE
1	EA	Seals	188S	ZER

Function:

Turn/Push button locking; pushing and turning button locks outside lever requiring use of key until the button is manually unlocked. Push-button locking; pushing button locks outside lever until unlocked by key or by turning the inside lever.

HDWE GROUP 11.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Passage lockset	ND10S	SCH
1	EA	Surface Closer	4050/4050 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	VON
1	EA	Wall Stop	WS406	IVE

Function:

Both levers always unlocked.

HDWE GROUP 12.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Privacy Lock	ND40 with occupied indicator	SCH
1	EA	Surface Closer	4050/4050 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE

Function:

Lever with emergency release recessed slot outside; push button in lever inside; springlatch; in unlocked state latch is retracted by either lever; outside lever is made inoperative by pushing button on inside lever; rotating inside lever retracts latch and releases button unlocking outside lever; closing door also unlocks preventing lockout; emergency unlock; an emergency key or small, flat screwdriver inserted in outside lever and turned releases button to unlock; inside lever always free for immediate egress.

HDWE GROUP 12.1

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Privacy Lock	ND40 with occupied indicator	SCH
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE

Function:

Lever with emergency release recessed slot outside; push button in lever inside; springlatch; in unlocked state latch is retracted by either lever; outside lever is made inoperative by pushing button on inside lever; rotating inside lever retracts latch and releases button unlocking outside lever; closing door also unlocks preventing lockout; emergency unlock; an emergency key or small, flat screwdriver inserted in outside lever and turned releases button to unlock; inside lever always free for immediate egress.

HDWE GROUP 12.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Privacy Lock	ND40 with occupied indicator	SCH
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE
1 Set	Seals	188S	ZER

Function:

Lever with emergency release recessed slot outside; push button in lever inside; springlatch; in unlocked state latch is retracted by either lever; outside lever is made inoperative by pushing button on inside lever; rotating inside lever retracts latch and releases button unlocking outside lever; closing door also unlocks preventing lockout; emergency unlock; an emergency key or small, flat screwdriver inserted in outside lever and turned releases button to unlock; inside lever always free for immediate egress.

HDWE GROUP 13.1

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Classroom lock	ND70	SCH
1 EA	Surface Closer	4050/4050 EDA with hold open	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE

Function:

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

HDWE GROUP 14.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Storeroom Lockset	ND80	SCH
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE

Function:

Latchbolt retracted by key outside or by lever inside. Outside lever always inoperative. Auxiliary latch deadlocks latchbolt when door is closed.

HDWE GROUP 14.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Storeroom Lockset	ND80	SCH
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE
1 Set	Seals	188S	ZER

Function:

Latchbolt retracted by key outside or by lever inside. Outside lever always inoperative. Auxiliary latch deadlocks latchbolt when door is closed.

HDWE GROUP 18.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Storeroom lock	ND80	SCH
1 EA	Electric strike	By Owner	
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE
1 EA	Card Reader	By Owner	
1 EA	Door Contact	By Owner	
1 EA	Power Supply	By Owner	
1 EA	Elevation drawing		
1 EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 18.1

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Storeroom lock	ND80	SCH
1 EA	Electric strike	By Owner	
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Overhead stop	90S	GLY
1 EA	Card Reader	By Owner	
1 EA	Door Contact	By Owner	
1 EA	Power Supply	By Owner	
1 EA	Elevation drawing		
1 EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 18.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Storeroom lock	ND80	SCH
1 EA	Electric strike	By Owner	
1 EA	Surface Closer	4050/4050 EDA with hold open	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE
1 EA	Card Reader	By Owner	
1 EA	Door Contact	By Owner	
1 EA	Power Supply	By Owner	
1 EA	Elevation drawing		
1 EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 19.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Push Plate	8200 6" x 16"	IVE
1 EA	Pull plate	8302 10" 4" x 16"	IVE
1 EA	Surface closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Wall Stop	WS406	IVE

Function:

Push/pull

HDWE GROUP 19.1

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Push Plate	8200 6" x 16"	IVE
1 EA	Pull plate	8302 10" 4" x 16"	IVE
1 EA	Surface closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE

Function:

Push/pull

HDWE GROUP 21.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 Set	Constant latch flushbolt	FB51T/FB61T	IVE
1 EA	Passage lock	ND10S	SCH
1 EA	Coordinator	COR x FL	IVE
2 EA	Surface Closer	4050/4050 EDA	LCN
2 EA	Kick Plate	8400 10" x 1" LDW B4E	IVE
2 EA	Fire/life wall mag	SEM7800	LCN
1 Set	Seals	188S	ZER
1 Set	Meeting edge seals	8193	ZER

Function:

Both levers always unlocked.

HDWE GROUP 28.0

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Power Transfer	EPT2	VON
1 EA	Automatic flushbolt	FB31T/FB41T	IVE
1 EA	EU Storeroom lock	ND80EU	SCH
2 EA	Surface Auto Operator	4642	LCN
2 EA	Actuator, wall mount	8310-853	LCN
1 EA	Coordinator	COR x FL	IVE
2 EA	Armor plate	8400 34" x 1" LDW B4E	IVE
1 EA	Card Reader	By Owner	
2 EA	Door contact	By Owner	
1 EA	Power Supply	By Owner	
1 EA	Elevation drawing		
1 EA	Wire Diagram	Point to point	

Function:

Outside lever continuously locked until unlocked by key or electric current. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Presentation of valid credential momentarily unlocks doors. Fail secure.

HDWE GROUP 28.1

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Power Transfer	EPT2	VON
1 EA	Constant latch flushbolt	FB51T/FB61T	IVE
1 EA	EU Storeroom lock	ND80EU	SCH
2 EA	Surface Closer	4050/4050 EDA with hold open	LCN
1 EA	Coordinator	COR x FL	IVE
2 EA	Kick Plate	8400 10" x 1" LDW B4E	IVE
1 EA	Card Reader	By Owner	
2 EA	Door contact	By Owner	
1 EA	Power Supply	By Owner	
1 EA	Elevation drawing		
1 EA	Wire Diagram	Point to point	

Function:

Outside lever continuously locked until unlocked by key or electric current. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Presentation of valid credential momentarily unlocks doors. Fail secure.

HDWE GROUP 38.2

Qty	Description	Product Number	Manufacturer
	Hinges	As specified	IVE
1 EA	Electric strike	By Owner	
1 EA	Panic hardware	99-L-NL-F	VON
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 Set	Seals	188S	ZER
1 EA	Card reader	By Owner	

1	EA	Door contact	By Owner
1	EA	Power Supply	By Owner
1	EA	Elevation drawing	
1	EA	Wire Diagram	Point to point

Function:

Latchbolt retracted inside by exit device push pad and outside by key in cylinder. Doors locks when key is removed and door is closed. Electric strike released by card reader.

HDWE GROUP 48.2

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
2	EA	Power transfer	EPT10	VON
2	EA	Electric panic hardware	QEL-9947-L-NL-F	VON
2	EA	Surface Closer	4050/4050 EDA	LCN
2	EA	Kick Plate	8400 10" x 1" LDW B4E	IVE
2	EA	Fire/life wall mag	SEM7800	LCN
2	Set	Seals	188S	ZER
1	Set	Meeting edge stiles	8193	ZER
1	EA	Card reader	By Owner	
2	EA	Door Contact	By Owner	
1	EA	Power Supply	By Owner	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Latchbolt retracted inside by exit device push pad and outside by key in cylinder. Doors locks when key is removed and door is closed. Electric strike released by card reader.

HDWE GROUP 259.0

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinge	700	IVE
1	EA	Pull/push bar	9103-0	IVE
1	EA	Surface auto operator	4642	LCN
2	EA	Actuator, wall mount	8310-853	LCN
1	EA	Wall stop	WS406	IVE

Function:

Push/pull

HDWE GROUP 358.0

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinge	700 x EPT	IVE
1	EA	Power Transfer	EPT10	VON
1	EA	Electric Panic Hardware	QEL+-99-NL-OP	VON
1	EA	Door pull, 1" round	8190 10"	IVE
1	EA	Surface auto operator	4642	LCN
2	EA	Actuator, wall mount	8310-853	LCN
1	EA	Rain Drip	142A	ZER
1	Set	Weather Strip	By Door Manufacturer	
1	EA	Door Sweep w/Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	

1	EA	Power Supply	As required
1	EA	Elevation drawing	
1	EA	Wire Diagram	Point to Point

Function:

Latchbolt retracted inside by device push pad and outside by key in cylinder. Door locks when key is removed. Valid credential will momentarily unlock the door. Door relocks when card reader times out.

END OF SECTION

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 07 2600 - Vapor Retarders.

1.03 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. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
- H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- I. BS EN 14179-1 - Glass in Building - Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass - Part 1: Definition and Description; 2016.
- J. GANA (GM) - GANA Glazing Manual; 2022.
- K. GANA (SM) - GANA Sealant Manual; 2008.
- L. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- N. ITS (DIR) - Directory of Listed Products; current edition.
- O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
- Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2026.
- R. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and 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.

1.05 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.

1.06 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.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. 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 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with applicable codes.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 4. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 - 1. In conjunction with weather barrier related materials described in other sections, as follows:
 - a. Air Barriers: See Section 07 2700.

2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.
 3. To maintain a continuous vapor retarder and/or air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 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. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 4. 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.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com.
 2. Guardian Glass, LLC: www.guardianglass.com.
 3. Oldcastle Building Envelope: obe.com.
 4. Pilkington North America Inc: www.pilkington.com.
 5. Viracon: www.viracon.com.
 6. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Warm-Edge Spacers: Flexible silicone with polyisobutylene (PIB) primary seal.
 - a. Spacer Width: As required for specified insulating glass unit.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 6. Color: Black.

7. Purge interpane space with dry air, hermetically sealed.
- C. Insulating Glass Units (INSUL GL-1): Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with argon.
 3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: To match existing.
 - b. Coating: Low-E (passive type), on #2 surface.
 - 1) Basis of Design:
 - (a) Guardian Industries: SunGuard SNX 62/27.
 - (b) Vitro Architectural Glass: Solarban 70.
 - (c) Viracon: VNE1-63.
 4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: To match existing.
 5. Total Thickness: 1 inch (25.4 mm).
 6. Thermal Transmittance (U-Value) Winter - Center of Glass: 0.24, maximum.
 7. Visible Light Transmittance (VLT): 62 percent, minimum.
 8. Solar Heat Gain Coefficient (SHGC): 0.26, maximum.
 9. Visible Light Reflectance, Outside: 11 percent, minimum.
 10. Visible Light Reflectance, Inside: 12 percent, minimum.
 11. Glazing Method: Dry glazing method, gasket glazing.

2.05 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.
 - 2) (GL-3): 1/2 inch (12.7 mm), nominal.
 5. Tint: Clear.

2.06 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.

2.07 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 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.

3.06 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.

1.02 RELATED REQUIREMENTS

- A. Section 07 2700 - Air Barriers: Air- and water-resistive barrier over sheathing.
- B. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- C. 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; 2025.
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
- G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
- H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- J. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.
- K. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2025.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- 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.

PART 2 PRODUCTS

2.01 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).

2.02 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Basis of Design: ClarkDietrich; www.clarkdietrich.com.
- C. Other Acceptable Manufacturers 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.
- D. 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 (FUR-1): Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 5. Furring Members : Zee-shaped sections, minimum depth as indicated on drawings.

2.03 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. (GYP BD-1): 5/8 inch Type X.
 - b. (GYP BD-9) 1/4 inch.
 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. Basis of Design: USG Corporation; Sheetrock Brand EcoSmart Gypsum Panels: www.usg.com.
 5. 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. Backing Board For Wet Areas: One of the following products:
1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type (GYP BD-16): Thickness: 5/8 inch (15.9 mm).
 - b. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - 1) Environmental Product Declaration (EPD) or Declare Label.
 - 2) Health Product Declaration (HPD).
 - c. Basis of Design: USG Corporation; Durock Brand Glass Mat Tile Backer Board: www.usg.com.
 - d. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - 1) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Type X Thickness (GYP BD-6): 5/8 inch (16 mm).
 3. Edges: Tapered.
 4. Basis of Design: USG Corporation; Sheetrock Brand Mold Tough EcoSmart.
 5. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.

2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
3. Core Type: Type X.
4. Type X Thickness (GYP SHTG-2): 5/8 inch (16 mm).
5. Edges: Square.
6. Basis of Design: USG Corporation; Securerock Brand Ultralight Glass-Mat Sheathing: www.usg.com.
7. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 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. Basis of Design: Owens Corning Unfaced Ecotouch Insulation.
 - a. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements.
- B. Backing Plate (MET BLKG-1): Metal backing plate. 20 gauge. Width and length as required for application.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- D. Vapor Retarder: See Section 07 2600.
- E. 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.
- F. 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. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- E. 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 A108.19 - 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.
- B. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.
- B. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- C. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.
- D. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.
- E. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.
- F. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2025-2026.
- G. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

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 (GT-#): 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. Basis of Design: As indicated on drawings.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, modified silane polymer, 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. Application: See Drawings for extent of tiling at bathtub.
 3. Fluid or Trowel Applied Type:
 - a. Products:
 - 1) LATICRETE International, Inc; 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 (Reapproved 2025).
- 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 Cass County Government'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. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch (24 mm) face width.
 - 3. Finish: Baked enamel.
 - 4. 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. Resilient stair accessories.
- D. 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 E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- B. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

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 Cass County Government'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 (RF-#): Type I- Homogeneous, color and pattern throughout thickness; Type II- Heterogeneous, laminated.
 - 1. Basis of Design: As indicated on drawings.
 - 2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
 - 3. Size: 18 by 18 inch (457 by 457 mm) nominal.
 - 4. Total Thickness: 0.125 inch (3.2 mm).

2.02 STAIR COVERING

- A. Rubber stair treads and risers (RST-#): Provide the same material at landings and other locations indicated by this tag in the room finish schedule.
 - 1. Basis of Design: See drawings for product information.
- B. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.
 - 1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648, NFPA 253, ASTM E648, or NFPA 253.
 - 2. Nosing: Square.
- C. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
 - 1. Thickness: 0.080 inch (2.0 mm).

2.03 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.

2.04 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 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

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

3.08 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; 2018.

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 Cass County Government'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 7200 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall covering.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Manufacturer's Instructions: Indicate installation special procedures.
- E. Maintenance Materials: Furnish the following for Cass County Government's use in project maintenance:
 - 1. See Section 01 6000 - Product Requirements for additional provisions.
 - 2. Extra Stock Materials: 25 feet (8 m) of each color and pattern of wall covering.
 - a. Package and label each roll by manufacturer, color, pattern, and destination room number.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials for damage upon arrival.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.06 FIELD CONDITIONS

- A. Maintain adhesive and wall covering manufacturer's recommended temperature ranges 24 hours before, during, and after installation.

PART 2 PRODUCTS

2.01 WALL COVERINGS

- A. Performance Requirements:
 - 1. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 50, maximum, when tested in accordance with ASTM E84.
- B. Wall Covering (WC-#): Fabric-backed vinyl roll stock.
 - 1. Basis of Design: See drawings for product information.

2.02 ACCESSORIES

- A. Adhesive: Type recommended by wall covering manufacturer.

- B. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) or at rate greater than 1/16 inch/ft (5 mm/m).
- D. Notify Architect of detrimental conditions affecting wall covering installation.
- E. Correct detrimental conditions before starting installation.

3.02 PREPARATION

- A. Remove wall plates and accessories impeding wall covering installation.
- B. Substrate Priming and Preparation:
 - 1. Fill cracks in substrate and correct irregularities with filler; sand smooth.
 - 2. For marks capable of bleeding through surface finishes, seal with shellac.
 - 3. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- C. Wash impervious surfaces with tetra-sodium phosphate; rinse and neutralize; wipe dry.
- D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing.
- E. Correct surface defects affecting work of this section and clean surfaces. Remove existing coatings exhibiting loose surface defects.
- F. Vacuum surfaces to remove loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall immediately before applying wall covering.
- C. Use wall covering in roll number sequence.
- D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.
- E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Butt edges tightly.
- G. Horizontal seams are not permitted.
- H. Do not seam within 2 inches (51 mm) of internal corners or within 6 inches (152 mm) of external corners.
- I. Install wall covering before installing bases and items attached to, abutting, or located within 1 inch (25 mm) of wall surface.
- J. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.
- K. Cover spaces above and below windows and above doors in pattern sequence from roll.
- L. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches (152 mm) of wall covering termination. Ensure complete contact bond.
- M. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.

- N. Reinstall wall plates and accessories removed to accommodate work of this section.

3.04 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.05 PROTECTION

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

END OF SECTION

SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound-absorbing panels.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.
- D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

PART 2 PRODUCTS

2.01 SOUND-ABSORBING UNITS

- A. Manufacturers:
 - 1. Conwed Designscape/Wall Technology: www.conweddesignscape.com.
 - 2. Egan Visual Corporation: www.egan.com.
 - 3. Essi Acoustical Products Company: www.essiacoustical.com.
 - 4. Rockfon; Baffles: www.rockfon.com.
 - 5. TECHLITE: www.techlite.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. General:
 - 1. Prefinished, 100% polyester (PET panels).
 - 2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Acoustical Panels for Walls (SAWP-#):
 - 1. Basis of Design: As indicated on drawings.

2.02 FABRICATION

- A. General: Fabricate panels to sizes and configurations as indicated, with fabric installed without sagging, wrinkles, blisters, or visible seams.

- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install mounting accessories and supports in accordance with shop drawings.
- C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- D. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
 - 1. Plumb and level.
 - 2. Flatness.
 - 3. Width of joints.

3.03 CLEANING

- A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

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. Glass.
 - 8. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 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.
- B. Divisions 21 through 26: Identification for mechanical and electrical systems.

1.03 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).
- 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.

- E. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

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 Cass County Government'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 Cass County Government.
 - 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. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 3. 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. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- G. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- J. 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.
- K. 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.
- L. 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 1100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass markerboards.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 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 C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, tackboard surface covering, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- D. Samples: Submit two samples 2 by 2 inch (50 by 50 mm) in size illustrating materials and finish, color and texture of markerboard, tackboard, and trim.
- E. Manufacturer's printed installation instructions.
- F. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY UNITS

- A. Magnetic Glass Markerboards (GLSBD-#):
 - 1. Basis of Design: As indicated on drawings.
 - 2. Glass: Laminated, low iron, 1/4 inch thick (6 mm thick), with bevel edges and radiused corners, laminated to steel backing sheet for use with magnets. Coated or treated for use as dry erase board or projection surface.
 - 3. Steel Backing Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
 - 4. Mounting: Concealed Z clips.

2.02 MATERIALS

- A. Float Glass: Provide float-glass-based glazing unless otherwise indicated.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
- C. Adhesives: Type used by manufacturer.

2.03 ACCESSORIES

- A. Magnetic Accessory Kit: Magnetic cup, magnetic eraser, dry erase markers, magnets, and microfiber cloth.
- B. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

3.03 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Remove temporary protective cover at Date of 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.

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 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

- A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 6 x 6 inch (152 x 152 mm) in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
 - 1. All American Metal Corp - AAMCO: www.allamericanmetal.com.
 - 2. Metpar Corp: www.metpar.com.
 - 3. Sanymetal Products Company: www.sanymetal.com.
 - 4. Scranton Products: www.scrantonproducts.com.
 - 5. Substitutions: Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments (COMP-1): Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), Class A, tested in accordance with NFPA 286; floor-mounted headrail-braced.
 - 1. Color: Single color as indicated on the Drawings.
- B. Doors:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: 24 inch (610 mm).
 - 3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - 4. Height: 55 inch (1397 mm).
- C. Panels:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Height: 55 inch (1397 mm).

- 3. Depth: As indicated on drawings.
- D. Pilasters:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Extruded aluminum, anti-grip profile.
 - 1. Size: Manufacturer's standard size.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- E. Hinges: Stainless steel, manufacturer's standard finish.
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 - 1. Door Latch: Slide type with exterior emergency access feature.
 - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
- G. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.
- B. Protective wall protection.

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.
- B. Protective Wall Covering:
 1. Construction Specialties, Inc: www.c-sgroup.com.
 2. Inpro: www.inprocorp.com.
 3. MDC Interior Solutions: www.mdcwall.com/#sle.
 4. Pawling Corp: www.pawling.com.
 5. 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 - Flush Mounted (CG-1):
 1. Basis of Design: As indicated on drawings.
- B. Protective Wall Panels (PLAM-3):
 1. Material: Laminated Wall Protection:
 - a. Basis of Design: As indicated on drawings.
- C. Adhesives and Primers: As recommended by manufacturer.
- D. 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.
- B. Position corner guard 4 inches (102 mm) above finished floor to ceiling.

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. Commercial shower and bath accessories.
- C. Diaper changing stations.
- D. Utility room accessories.

1.02 RELATED REQUIREMENTS

- A. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.
- 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.
- F. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

1.04 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. Framed Mirrors (MIR-10): Stainless steel framed, 6 mm thick tempered glass mirror.
 - 1. Basis of Design: 780 Series manufactured by Bradley.
 - 2. Size: As indicated on drawings.
 - 3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, concealed mounting brackets; satin finish.
- 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-24): 24 inches. Basis of Design 812 Series by Bradley.
 - 3) (GB-36): 36 inches. Basis of Design 812 Series by Bradley.
 - 4) (GB-42): 42 inches. Basis of Design 812 Series by Bradley.
- C. Sanitary Napkin Disposal Unit (ND-1): Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Basis of Design: Model 4722-15 manufactured by Bradley.
- D. Coat Hook (HK-1): Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.
 - 1. Basis of Design: Model 9134 manufactured by Bradley.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Tracks (TRACK-1): Extruded aluminum sections; one piece per track run.
 - 1. Profile: Channel.
 - 2. Mounting: Surface.
 - 3. Structural Performance: Capable of supporting vertical test load of 50 lbs (23 kg) without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
 - 4. Track End Stop: To fit track section.
 - 5. Track Bends: Minimum 12 inch (300 mm) radius; fabricated without deformation of track section or impeding movement of carriers.

6. Suspension Rods: Tubular aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
 7. Escutcheons: Where suspension rod meets finished ceiling or structure, provide escutcheons to match rod finish.
 8. Finish on Exposed Surfaces: White enamel.
 9. Basis of Design: InPro Corporation; Ultra Cube Track System.
 - a. Substitutions: See Section 01 6000 - Product Requirements.
 10. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.
 - a. Coordinate with Owner for required quantity.
 11. Wand: Plastic, attached to lead carrier, for pull-to-close action.
 12. Installation Accessories: Types required for specified mounting method and substrate conditions.
- B. Curtains:
1. All Curtain Material: Furnished by Owner, Installed by Contractor.

2.06 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Basis of Design (BCS-1): Model KB300 manufactured by Koala Care.
 2. Material: Polyethylene.
 3. Mounting: Surface.

2.07 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 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, and rough-in measurements for recessed cabinets.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
 - 2. Ansul, a Tyco Business: www.ansul.com.
 - 3. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 4. Pyro-Chem, a Tyco Business: www.pyrochem.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 1. Provide one fire extinguisher for each cabinet or bracket indicated on the drawings.
 2. Basis of Design: Cosmic by JL Industries.
 3. Class: A:B:C type.
 4. Size: 10 pound (4.54 kg).
 5. Finish: Baked polyester powder coat color as selected.
 6. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire-Rated Construction: Provide fire-rated cabinets in fire-rated walls (see drawings for locations).
- B. Cabinet Configuration (FCAB-1): Semi-recessed type.
 1. Size to accommodate accessories.
 2. Basis of Design: JL Industries "Ambassador Series" sized for 10 lb fire extinguisher.
 3. Projected Trim: Returned to wall surface, with 2-1/2 inch (63 mm) projection, and 1-3/4 inch (44 mm) wide face.
 4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- D. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Fabrication: Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets.

END OF SECTION

SECTION 12 2113 - HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating physical and dimensional characteristics.
- C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- D. Samples: Submit two samples, 6 inch (152 mm) long illustrating slat materials and finish, cord type and color.
- 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 Slats: 20 of each type and size.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal Louver Blinds:
 - 1. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.
 - 2. SWFcontract, a division of Spring Window Fashions, LLC: www.swfcontract.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BLINDS

- A. Description (WT-2): Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- C. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
 - 1. Width: 1 inch (25 mm).
 - 2. Thickness: 0.008 inch (0.20 mm).
 - 3. Color: As selected by Architect.
 - 4. Basis of Design: Hunter Douglas Riviera Commercial Aluminum Blinds.
- D. Slat Support: Woven polypropylene cord, ladder configuration.

- E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
 - 1. Color: Same as slats.
- F. Lift Cord: Braided nylon, continuous loop with restraining device; comply with WCMA A100.1.
 - 1. Free end weighted.
 - 2. Color: As selected by Architect.
- G. Control Wand: Extruded hollow plastic; hexagonal shape.
 - 1. Removable type.
 - 2. Length of window opening height less 3 inch (76 mm).
 - 3. Color: Clear.
- H. Headrail Attachment: Wall brackets.

2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to fit within openings with uniform edge clearance of 1/2 inch (13 mm).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings are ready to receive the work.
- B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with concealed fasteners.

3.03 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).
- B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust blinds for smooth operation.

3.05 CLEANING

- A. Clean blind surfaces just prior to occupancy.

END OF SECTION

SECTION 12 2400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior manual roller shades.

1.02 REFERENCE STANDARDS

- A. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
- B. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
- E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: One year.
 - 3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Manually Operated Roller Shades:
 - 1. Draper, Inc: www.draperinc.com.
 - 2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.
 - 3. MechoShade Systems LLC: www.mechoshade.com.
 - 4. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROLLER SHADES

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
 - 3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
 - a. Comply with NFPA 70.
 - b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
 - c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.
- B. Roller Shades (WT-1) - Basis of Design: MechoShade Systems LLC; Mecho/5 System; www.mechoshade.com.
 - 1. Description: Single roller, manually operated fabric window shades.
 - a. Drop Position: Regular roll.
 - b. Mounting: Window jamb mounted.
 - c. Size: As indicated on drawings.
 - d. Fabric: As indicated under Shade Fabric article.
 - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch (3 mm) thick.
 - 3. Roller Tubes:
 - a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
 - 4. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
 - 5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.

- a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
 - b. Brake must withstand minimum pull force of 50 lb (22.7 kg) in the stopped position.
 - c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
- 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb (43 kg) minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
- 7. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.

2.03 SHADE FABRIC

- A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - 1. Basis of Design: As indicated on drawings.

2.04 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
 - 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

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

- B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
- C. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.06 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Sinks molded into countertops.

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. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.
- E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- F. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- H. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- I. 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. Plastic Laminate Countertops (PLAM-#): High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Basis of Design: See drawings for product information.
 - 2. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal 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: Matte or suede, gloss rating of 5 to 20.
 - 3. Exposed Edge Treatment: Molded rubber edge sized to completely cover edge of panel.
 - 4. Back and End Splashes: Same material, same construction.
 - a. Provide where indicated on the Drawings.
 - 5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
- C. 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. Sinks and Bowls: Integral castings; minimum 3/4 inch (19 mm) wall thickness; comply with IAPMO Z124.
 - c. 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.
- D. Natural Quartz and Resin Composite Countertops (QTZ-#): Sheet or slab of natural quartz and plastic resin over continuous substrate.
 - 1. Basis of Design: See drawings for product information.
 - 2. Flat Sheet Thickness: 1-1/4 inch (32 mm), minimum.
 - 3. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. NSF approved for food contact.

- d. Finish on Exposed Surfaces: Polished.
- 4. Other Components Thickness: 3/4 inch (19 mm), minimum.
- 5. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
- 6. 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 plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- C. Attach countertops using compatible adhesive as well as mechanical fasteners.
- D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 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 0060 - FIRE PROTECTION DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Unless otherwise noted in the Documents, all salvage items removed in connection with this Contract are to become the property of the Contractor, however the Owner shall have the first right of refusal on all equipment removed.

1.02 SECTION INCLUDES

- A. Demolition and removal of all fire protection equipment and distribution conduits including but not limited to piping, controls, and accessories in existing building.

1.03 RELATED REQUIREMENTS

- A. General and Supplementary Conditions and other Division 1 Specification Sections apply to this section

1.04 REFERENCE STANDARDS

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS

- A. See Division 1 - Administrative Requirements for submittal procedures.
- B. Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. Schedule of selective demolition activities:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of building utility services.
 - 3. Coordination for shutoff, capping and continuation of services.
 - 4. Coordination of Owner's continued occupancy of portions of existing building and of Owner's occupancy of completed work.
- D. Pre-demolition photographs or videotape showing existing pre-demolition conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before demolition work begins.

1.06 PROJECT CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct demolition so Owner's operation will not be disturbed. Provide not less than 48-hour notice to Owner of activities that will affect the Owner's operations.
- B. Maintain existing services to Owner occupied areas during demolition if possible or coordinate interruption of services prior to demolition.
- C. Owner assumes no responsibility for condition of area to be selectively demolished.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work
- E. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and existing ductwork and piping arrangements are as shown on Drawings.
- B. Verify that abandoned equipment serves only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents. The demolition Drawings are diagrammatic and show the general scope of demolition work and do not show all the construction detail of the original record drawings. Report discrepancies to the Project Engineer before disturbing existing installation.
- D. Visit the existing building and grounds and review existing building record drawings to familiarize with existing conditions prior to submitting bid. No allowance will be made subsequently, in this connection, on behalf of the Contractor for any error or negligence on his part.
- E. Beginning of demolition means the Contractor accepts existing conditions.

3.02 PREPARATION

- A. Disconnect mechanical systems in areas scheduled for removal. Notify Project Engineer and Owner of areas to be affected by mechanical demolition work prior to commencing.

3.03 SELECTIVE DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and remove from site and extend existing mechanical work under provisions of this Division and as indicated on the Drawings unless otherwise noted.
- B. Salvage items noted to remain the property of the Owner shall be delivered to a location to be designated by the Owner. Contractor shall remove from construction areas all trash or debris as it accumulates and dispose of it off site at no additional cost to the Owner. All construction areas shall be kept clean, safe, and orderly at all times. At the completion and acceptance for work, Contractor shall remove from the site all debris and surplus materials resulting from this work and dispose of them off site at no additional cost to the Owner.
- C. Do not use cutting torches until work area is clear of flammable materials. At concealed spaces verify condition and contents of hidden space before starting flame cutting operations. Maintain Fire Watch and portable fire-suppression devices during flame-cutting operations. Maintain and evaluate ventilation during flame-cutting operations.
- D. Maintain ventilation for dust control during selective demolition process. Verify Owner requirements for dust control and conform to their standards for all demolition activities.
- E. Remove, relocate, and extend existing installations to accommodate new construction as required for proper installation and system operation.
- F. Remove all accessories above grade. When removing equipment all associated pipe, etc. shall be removed and capped as required. Cut piping, etc. behind walls, above ceilings and below floors, and patch surfaces to match existing conditions. Finishes will be by others unless otherwise noted in documents.
- G. Neatly cut openings and holes plumb, square and true to dimension required. Use cutting methods least likely to damage construction to remain or adjoining construction. Cut and drill from exposed surfaces into concealed surfaces to avoid marring or spalling of finished surfaces. Temporarily cover openings to remain.

- H. Patch all openings created by removal of pipes, etc. unless noted as being patched by others. Openings to be patched to match existing with similar materials and finish unless otherwise noted.
- I. Seal all existing roof penetrations, which will not be reused. Roof patching shall be by project roofing contractor, or an Owner approved roofing contractor.
- J. Remove, relocate, or provide brackets, hangers, and other accessories as required.
- K. Repair adjacent construction and finishes damaged during demolition and extension work.
- L. Maintain access to existing mechanical installations, which remain active.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment, which remain or are to be returned to the Owner.
- B. All building surfaces damaged and openings left by new Work or the removal or relocation of mechanical equipment, piping, etc., shall be repaired to original condition and painted by the Contractor.

END OF SECTION

SECTION 21 0100 - FIRE PROTECTION GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 APPLICABILITY

- A. This section applies to and forms a part of each of the sections of Division 21. This section, and each of the sections to which it applies, is subject to the requirements of the Instructions to Bidders, General Conditions, and Special Conditions of these complete specifications.
- B. The work covered by this Division of the Specifications consists of furnishing all labor, supervision, equipment, materials, all incidentals, related items, and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.
- C. Only such items as are hereinafter specified or indicated on the drawings to be furnished by others, shall be considered to be furnished by others. All other items are to be considered as a part of this Contract and shall be so bid.
- D. The omission of specific reference to any parts necessary to, or reasonably incidental to, a complete installation shall not be construed as releasing the Contractor from furnishing and installing same.
- E. All work shall be finished, tested and ready for operation.

1.02 DEFINITIONS

- A. Word "Furnish" where written in Division 21 specifications and drawings shall mean Contractor shall deliver to the site item(s) specified, as well as additional specialized materials and/or accessories necessary for the use and operation of item or items specified.
- B. Word "Install" where written in Division 21 specifications and drawings shall mean Contractor shall set in position, connect (including sub-assemblies furnished), and adjust for use. Contractor shall furnish miscellaneous specialty items such as hangers, valves, unions, piping, sheet metal, etc., as obviously necessary for a complete and operating installation.
- C. Word "Material" where written in Division 21 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.
- D. Word "Labor" where written in Division 21 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment, and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.
- E. Word "Provide" where written in Division 21 specifications and drawings shall mean "Mechanical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".

1.03 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

- A. Notify the Engineer of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.
- B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.
- C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.
- D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished, and installed.
- E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material

is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.

- F. Any work not clear to Contractor shall be referred to Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Engineer, whose decision is final, without additional charges.
- G. By virtue of submitting a bid, Contractor agrees that he is skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that he has carefully reviewed all drawings, all specifications, and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

1.04 DRAWINGS

- A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, connections, and accessories which may be required. Furnish offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.
- B. All piping shall be routed so as not to obstruct access to other equipment. Routing indicated on drawings is representative of intended location but shall be field verified. It shall be this contractor's responsibility to coordinate with other trades for accessibility.
- C. Any work or system on the roof not explicitly indicated on the roof plan shall be approved by the engineer prior to installing.
- D. In general, the mechanical equipment drawings are drawn to scale as noted. Obtain dimensions and locations of partitions, walls, etc., from the Architectural drawings wherever possible and do not scale the mechanical drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.
- E. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.05 SITE INSPECTION

- A. Before submitting a proposal for the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themselves with all the existing conditions and limitations, including the extent of demolition, cutting, and patching to be done by the Contractor for Mechanical Work. No extras will be allowed because of the Contractor's misunderstanding as to the amount of work involved, or his lack of knowledge of any condition in connection with the work.

1.06 PRIOR APPROVAL REQUESTS

- A. Where the Bid Documents stipulate a particular Product, substitutions will be considered by the Engineer up to 10 days before receipt of bids.
- B. The submission shall provide complete information, test, etc. relating to quality, performance, suitability, to determine acceptability of such products.
- C. When a request to substitute a Product is made, the Engineer may approve the substitution and will issue an Addendum to known bidders.
- D. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.

- E. The cost of any changes of other trades as a result of use of the substitution material or equipment must be borne by the Contractor submitting such material or equipment.

1.07 REVIEW OF MECHANICAL MATERIALS AND EQUIPMENT

- A. Within thirty (30) days after award of construction contracts, Contractor shall submit for acceptance to the Architect quantity of shop drawings specified for the equipment indicated in these specifications. The shop drawings shall include the equipment manufacturer's name and address, catalog designation or model number, rough-in data & dimensions, performance curves and rated capacities & operational characteristics.
- B. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to submittal. Each shop drawing set shall be stamped, signed, and dated indicating Contractor review and submitted electronically via PDF file format. The PDF file name shall include the relevant specification section number for reference. If the Contractor fails to properly review shop drawings, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.
- C. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.
- D. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.
- E. The Engineer will review all Shop Drawings submitted and will retain a copy for record file.
- F. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:
 - 1. "No Exception Noted" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation.
 - 2. "Make Corrections Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time.
 - 3. "Revised and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at his discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
 - 4. "Rejected" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.
- G. Should the contractor fail to comply with any of the requirements of the preceding subparagraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.
- H. When the contractor chooses to furnish and reviewed material or equipment that requires electrical specifications/connections (circuit breaker, conduit, wire, labor, etc.) different than shown and/or scheduled on the drawings, or specified in detail, the contractor shall be responsible for coordinating any necessary changes and shall bear the cost of such changes (including engineering costs).

1.08 PROPOSAL REQUESTS AND INSTRUCTIONS

- A. For any proposal request or instruction that requires an adjustment to the Contract Sum, submit an itemized quotation for the change(s) described in the proposed modifications to the Contract Documents. Proposal shall also indicate credits, deducts, and/or offsets for material and labor originally included in contract.
 - 1. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. Breakdown shall include amounts, lengths, quantities, types, sizes, etc. of material.
 - 2. Indicate applicable taxes, O&P, delivery charges, equipment rental, and other incidental charges.
 - 3. Include costs of labor and supervision directly attributable to the change.
 - 4. All sub-contractor pricing shall include the same breakdown as described above.

1.09 WARRANTY

- A. All equipment and installation shall be provided with a 1-year warranty beginning with substantial completion.
- B. Refer to individual spec sections for specific warranty information that is different than stated above.
- C. Submit warranty with related forms completed in Owner's name and registered with manufacturer.

1.10 MANUALS

- A. In addition to catalog data and shop drawings submitted for review, this contractor shall furnish Operation and Maintenance Manuals for the mechanical systems. Manuals shall be delivered to the Architect before final observation of the work.
- B. Operation and Maintenance Manuals shall be furnished in PDF electronic format as well as two (2) copies bound in new hard backed 3 ring binders with the title "Operations and Maintenance Manuals" and the project title clearly printed on the front cover and side of binder .
- C. Provide an index at the beginning of the manual for the sections included in the manual.
- D. All sections in hard copy manuals shall be referenced with plastic tabs.
- E. Include at the front of the manual a complete listing of the Architect, Engineer and contractors and sub-contractors used on the project. Listing shall include names, addresses and phone numbers for each.
- F. Manuals shall be arranged in order similar to the specifications. All major pieces of equipment shall be referenced with tabs. At the beginning of each section, the equipment supplier's name, address, and phone number shall be provided.
- G. Data for equipment included in the manuals shall include:
 - 1. Approved shop drawings clearly showing the models, sizes and capacities of equipment used.
 - 2. Operations Manuals detailing step by step procedure to follow putting the equipment into operation.
 - 3. Maintenance Manuals from the manufacturer of each piece of equipment including instructions on installation, maintenance, and lubrication. Manuals shall include parts lists for all replacement parts.
- H. The following items shall also be included in the manuals for the Owners information: Factory start-up reports, Valve Tag list, Certificate of tests performed on Fire Protection System as submitted to insurance company, and Signed owner instruction forms for all items specified as requiring owners instruction.
- I. Operations and Maintenance Manuals shall be submitted to the Engineer for approval prior to delivery to the Architect.

1.11 INSTRUCTION OF OWNER'S EMPLOYEES

- A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.
- B. An Operating and Maintenance Manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- C. The number of man hours of instruction furnished for each system shall be as specified in other sections of this specification. Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 75% of time used for an initial instruction and 25% of time used for a follow up instruction, a minimum of four (4) weeks after initial instruction.
- D. "Instruction of Owner's Employees" form at end of section shall be filled out and signed by Contractor and Owner's Representative and three (3) signed copies of form sent to Engineer.
- E. Owner training and instructions:
 - 1. Sprinkler system including but not limited to piping, heads, alarms, etc. shall not be less than four (4) man hours.

1.12 MECHANICAL LIST OF CONSTRUCTION CLOSEOUT DOCUMENTS

- A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed in Appendix 'A' at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an N/A where items don't pertain.

1.13 INSTALLATION OF EQUIPMENT

- A. All equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications. Auxiliary piping, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.
- B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.

1.14 RECORD DRAWING

- A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.
- B. The contractor shall note on the record drawings the elevations and/or inverts of water service where it exits the building foundation.
- C. A complete set of these drawings shall be scanned at a resolution of 600dpi in color and saved in an Adobe PDF portfolio format with index to each sheet by name and burned to a non-volatile media. The electronic copy of the as-built drawings shall be transmitted to the Engineer. After review and approval by the Engineer, the as-built drawings will be turned over to the Owner.

1.15 COOPERATION WITH OTHER TRADES

- A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

1.16 INSPECTION OF SITE

- A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themselves with all of

the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.17 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

- A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.18 CODES, ORDINANCES, REGULATIONS & STANDARDS

- A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.
- B. All work shall conform to applicable state and local codes, ordinances, regulations and/or standards.

1.19 PERMITS AND LICENSES

- A. This contractor shall obtain and pay for all licenses and permits and shall pay for all fees and charges for the connection to outside services and use of property other than the site of the work for storage of materials or other purposes.
- B. Contractor shall coordinate and request all inspections from authority having jurisdiction. The Contractor shall notify the Architect of all such coordinated inspections (date & time) and shall submit certificates of inspection and final approval of the local inspection authority.

1.20 TESTS

- A. Test all equipment installed under these specifications and demonstrate its proper operation to the Engineer.
- B. Do not test or operate equipment for any purpose, until it has been fully lubricated in accordance with the manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to the piping system with sufficient water so that it will not run dry.
- C. All testing shall be completed before final inspection, and test results shall be available during the final inspection.

1.21 GUARANTEES

- A. This contractor shall guarantee all equipment, material, and workmanship for a period of one year from date of final certificate. Any defects in mechanical equipment, workmanship or materials that appear, or cause trouble of any kind within a period of one year from date of final certificate shall be remedied, free of charge. Refer to other sections of these specifications for guarantees in excess of the requirements herein described.

1.22 CONSTRUCTION CLOSEOUT DOCUMENTS

- A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an NA where items don't pertain.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 INSTRUCTION TO OWNER'S EMPLOYEES FORM:

DATE _____

INSTRUCTION OF OWNER'S EMPLOYEES

This letter shall certify that the Contractor has furnished the Owner with full instructions in the care and operation of all parts of the mechanical system as specified under Section 21 0100 paragraph entitled "Instruction of Owner's Employees".

	Initial Instructions			Follow-up Instructions		
Section	Hours	Date	Owners Initials	Hours	Date	Owners Initials
Sprinkler System	_____	_____	_____	_____	_____	_____

Contractor _____

Owner Representative _____

3.02 LIST OF CONSTRUCTION CLOSEOUT DOCUMENTS:

<u>SECTION</u>	<u>DOCUMENT</u>	<u>DATE / INITIALS</u>	<u>APPROVED</u>
21 00 00	Record Drawings Fire Protection		
21 00 00	O&M Manuals Fire Protection		
21 00 00	Owners Instruction Fire Protection		
21 00 00	Provide letter/certification from state/city of acceptance		

END OF SECTION

SECTION 21 0150 - FIRE PROTECTION MATERIALS & METHODS

PART 1 GENERAL

1.01 APPLICABILITY

- A. This section covers basic materials and methods and applies to and forms a part of each of the sections of Division 21.
- B. This work shall be in accordance with this and other applicable sections and/or provisions of these specifications and with the applicable drawings.

1.02 MATERIALS & MANUFACTURERS

- A. All materials and equipment shall be new, free of defects, installed in accordance with manufacturer's current published recommendations in a neat manner and in accordance with standard practice of the industry.
- B. Certain materials and/or equipment in this specification are specified by manufacturer and catalog numbers. The design was based on the specified equipment and establishes a degree of quality, performance, physical configuration, etc. If the contractor should elect to use equipment other than the equipment used as a basis for design but listed as "acceptable" in the specifications, he shall be responsible for space requirements, configuration, performance, and changes in bases, supports, vibration isolators, structural members, openings in structure and other apparatus that may be affected by its use.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 COORDINATION OF OPENINGS

- A. This contractor shall coordinate all openings required for new piping, equipment, controls, etc. through any structural slabs, beams, or walls. Contractor shall request a copy of the precast concrete shop drawings and verify locations and sizes of all openings required.
- B. All costs associated with structural field changes or redesigns of the building systems due to lack of field coordination shall be responsibility of this contractor.

3.02 PROTECTION, DELIVERY AND STORAGE OF MATERIALS

- A. Make provisions for the delivery and storage of materials and make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Protect materials and equipment stored on site from weather and moisture by maintaining factory covers and/or suitable weather-proof coverings. For extended outdoor storage, motors shall be removed from equipment and stored separately.
- C. The open ends of all piping shall be covered whenever that system is not being worked on, i.e. end of the workday, completion of a section, etc. Covering shall keep dust, garbage, vermin, and other foreign objects out of the piping when the contractor is not on the jobsite.

3.03 CUTTING AND REPAIRING

- A. All holes and penetrations required for the installation of the fire protection equipment shall be by the fire protection contractor. This shall include all piping and any other penetration through the wall, floor, or roof.
- B. Cutting construction shall be done only with the written permission of the Architect. Cutting shall be done carefully and damage to buildings, pipes, wiring, or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional charge to the Owner. This Contractor shall be responsible for all cutting and patching unless such work has been delegated to the General Contractor.

- C. All holes cut into concrete shall be cut by means of power saws or core drills. All unsightly spalls or chips shall be repaired.
- D. All openings remaining around pipe penetrations shall be filled, caulked, and painted to match wall. Code approved fire caulking shall be used for all rated penetrations.

3.04 SEALING FLOOR, CEILINGS AND WALL OPENINGS

- A. Where pipes pass through walls, ceilings, floors, or partitions, (other than those through fire rated walls or chases) the opening in the construction around the pipe shall not exceed ½ inch average clearance on all sides and shall be sealed to prevent the passage of sound and air. Coordinate wall openings to allow insulation thickness to pass through walls if allowed.
- B. The material used to seal space between the wall and the pipe shall be non-combustible caulk type, or wrap type, as conditions require. Provide sheet metal angles or flanges as may be required to contain the stopping material. Use of expanding foam will be allowed if surfaces are cleaned of an excess material and all edges are trimmed smooth. Penetrations through exterior walls shall be sealed weather tight.
- C. Special attention shall be given to penetrations of mechanical room walls. Fill gaps around entire exterior area of the pipes with sound insulation (batt or mineral wool) to within ½" of the wall surface. Use silicone caulking to finish filling the opening smooth with the wall surface or provide sheet metal angles. All sealer shall meet flame spread 25 and smoke developed less than 50.
- D. Where pipes pass through fire-rated walls, ceilings, floors, vertical service shafts walls, or partitions, the opening in the construction around the pipe or duct shall be fire-stopped to prevent the passage of flame and smoke. All assemblies shall be UL or ASTM listed to provide a fire rating equal to that of the construction being penetrated. For the firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests shall be submitted from the manufacturer to the local authorities having jurisdiction for their review and approval prior to installation. Individuals installing the firestopping shall be experienced and certified as required by the manufacturer whose product is being applied. Refer to firestopping spec section for more information.
- E. Manufacturer's assembly drawings shall be provided in O & M Manuals for each type of penetration. Printed metal or plastic labels shall be permanently applied on the structure within 6" of the edge of the firestop system. Metal labels shall be applied with mechanical fasteners & plastic labels shall be the self-adhering type with adhesive capable of permanently bonding labels to the surfaces on which the labels are placed. The information required on the label include UL/ASTM assembly number, date of installation, fire stopping material manufacture name, Contractor's name, address & phone number & the installer's name.
- F. Acceptable manufacturers shall be Hilti, 3M Brand, or a prior approved product.

3.05 CLEANING AND PAINTING

- A. Clear away all debris, surplus materials, etc., resulting from work or operations, leaving the job and equipment furnished under this contract in a clean condition.
- B. All equipment being furnished with finished paint coat shall be examined upon job completion for scratches and other surface damage. All finished surfaces where necessary shall be touched up with touch-up paint of color to match the factory finish.
- C. Paint all exposed bare pipe exterior of the building. Bare pipe shall be painted one coat of No. 7769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Final coat shall be of a color selected by the architect.
- D. Paint all exposed iron and steel work, pipe hangers, pipe stands, uninsulated tanks, supporting steel for equipment and exposed bare pipe in mechanical areas. Iron and steel work and bare pipe shall be painted one coat of No. 4769402 damp-proof red primer as manufactured by

Rust-Oleum Corporation, or equal, and one coat of oil paint. Iron and steel work shall be painted black.

- E. Refer to Section 09, Painting for additional requirements.

3.06 ASBESTOS FREE BUILDING

- A. There shall be no products or building materials used as a temporary or permanent element in the construction of this building, which has in its make-up any form of asbestos. The contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building and remind material suppliers that their products must be asbestos free.
- B. Notify the Architect immediately of any existing materials which are suspected of containing asbestos. Do not disturb or attempt to remove any asbestos containing material. The Architect will contact the Owner and inform them of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos removal.

3.07 SALVAGE

- A. All items removed from existing building shall be salvaged in a workmanlike manner.
- B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

END OF SECTION

SECTION 21 0553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Closeout Documents:
 - 1. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
 - 2. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.
 - 3. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Control Panels: Nameplates.
- B. Major Control Components: Nameplates.
- C. Piping: Pipe markers.
- D. Pumps: Nameplates.
- E. Valves: Tags and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products, a Tricor Direct Company: www.seton.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Laminated three-layer plastic with engraved letters.

2.03 TAGS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products, a Tricor Direct Company: www.seton.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 2. Seton Identification Products, a Tricor Company: www.seton.com.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Color: Comply with ASME A13.1.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings. Provide sticker/tape around the circumference of the piping at each end of pipe marker to hold marker in place.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Markers shall be applied where pipes pass through walls (both sides of the wall), at each change of direction and on each 20 feet of straight lengths.
1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 21 0784 - MECHANICAL FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all mechanical through and membrane penetrations in fire-resistance rated and smoke-resistant assemblies , whether indicated on drawings or not .

1.02 REFERENCE STANDARDS

- A. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2009.
- B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- C. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.
- D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.
- F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Closeout Documents:
 - 1. Certificate from authority having jurisdiction indicating approval of materials used.

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 the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) 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. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors , or meeting any two of the following requirements:.
 - 2. With minimum 3 years documented experience installing work of this type.
 - 3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
 - 4. Licensed by authority having jurisdiction.

1.05 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
- B. Obtain approval of authority having jurisdiction before proceeding.
- C. If accepted, mock-up will represent minimum standard for the Work.
- D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.06 SCOPE / APPLICATION

- A. Provide installed firestop protects that limit the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in rated assemblies, including walls, partitions, floors, roof/ceilings, and similar locations. restoring the integrity of the fire rated construction to its original fire rating.

- B. Provide firestop systems listed for the specific combination of fire rated construction, type of penetrating item, annular space requirements, and fire rating, and the following criteria:
 - 1. F-Rating: Equal to or greater than the fire-resistance rating of the assembly in which the firestopping will be installed.
 - 2. T-Rating: In habitable areas where penetrating items are exposed to potential contact with materials on fire side(s) of rated assembly, T-rating must equal its F-rating.
 - 3. L-Rating: L-rating of 1 cfm per linear foot (5.5 cu m/h/m) maximum at ambient temperatures.
 - 4. Wall Penetrations: Systems must be symmetrical, with the same rating from both sides of the wall.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. A/D Fire Protection Systems Inc: www.adfire.com.
- B. 3M Fire Protection Products: www.3m.com/firestop.
- C. Hilti, Inc: www.us.hilti.com.
- D. Nelson FireStop Products: www.nelsonfirestop.com.
- E. RectorSeal: www.rectorseal.com.
- F. International Protective Coatings Corp.

2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.
 - 2. Fire Ratings: See Drawings for required systems and ratings.

2.03 MATERIALS

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Cast-in-Place Devices: Firestopping device for use prior to a concrete pour. Adjustable height with pull tabs, straight edge design for close placement to walls and adjacent devices.
 - 1. Fire Resistance: For use in 1, 2, or 3 hour fire rated systems.
- C. One piece metal collar assembly encasing intumescent material for firestopping of pipes and cables through rated walls and floors.
 - 1. Fire Resistance: For use in 1 or 2 hour fire rated systems.
- D. Plastic Pipe Device: Intumescent device for firestopping of plastic pipe and cables through rated walls and floors.
 - 1. Configuration: One-piece metal collar, with locking latch and bendable tabs to secure; equipped also for conventional anchoring.
 - 2. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- E. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant;
 - 1. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- F. Foam Firestopping: Single component silicone foam compound;
- G. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers;
- H. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening;

- I. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, intended to be installed after penetrating item has been installed;
- J. Firestop Devices - Cast-In Type: Sleeve and sealing material, intended to be cast in concrete floor forms or in concrete on metal deck, not requiring any additional materials to achieve penetration seal.
 - 1. Durability and Longevity: Permanent.
- K. Intumescent Putty: Compound that expands on exposure to surface heat gain.
 - 1. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- L. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration;:
- M. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- C. Remove incompatible materials that could adversely affect bond.
- D. Install backing materials to arrest liquid material leakage.
- E. Verify that items penetrating fire rated assemblies are securely attached, including sleeves, supports, hangers, and clips.
- F. Verify that openings and adjacent areas are not obstructed by construction that would interfere with installation of firestopping, including ducts, piping, equipment, and other suspended construction.
- G. Install masking and temporary coverings as required to prevent contamination or defacement of adjacent surfaces due to firestopping installation.

3.03 INSTALLATION

- A. Non-rated assemblies shall be draft stopped.
- B. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- C. Install so that openings are completely filled and material is securely adhered.
- D. Where firestopping surface will be exposed to view, finish to a smooth, uniform surface flush with adjacent surfaces.
- E. After installation is complete, remove combustible forming materials and accessories that are not part of the listed system.
- F. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned.
- G. Do not cover firestopping with other construction until approval of authority having jurisdiction has been received.
- H. Do not cover installed firestopping until inspected by authority having jurisdiction.
- I. Install labelling required by code.

- J. Install identification Labels for Through Penetration and Construction Joint Systems: Pressure sensitive self-adhesive vinyl labels, preprinted with the following information:
 - 1. The words "Warning - Through Penetration Firestop System - Do not Disturb. Notify Building Management of Any Damage."
 - 2. Listing agency's system number or designation.
 - 3. System manufacturer's name, address, and phone number.
 - 4. Installer's name, address, and phone number.
 - 5. General contractor's name, address, and phone number (if applicable).
 - 6. Date of installation.

3.04 CLEANING

- A. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned
- B. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

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

END OF SECTION

SECTION 21 1100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water pipe.
- B. Valves.
- C. Bedding and cover materials.
- D. Accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
- B. ASTM B63 - Standard Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials; 2007 (Reapproved 2026).
- C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2017a.
- D. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019 (Reapproved 2025).
- E. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; 2022.
- F. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- G. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- H. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.
- I. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.
- J. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.
- K. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings; 2021.
- L. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.
- M. AWWA M23 - PVC Pipe—Design and Installation; 2020.
- N. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturer's catalog information.
 - 3. Indicate valve data and ratings.
 - 4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.
 - 5. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Closeout Documents:
 - 1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.
 - 2. Maintenance Data: Include installation instructions, spare parts lists, and exploded assembly views.

1.04 QUALITY ASSURANCE

- A. Provide grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.
- B. Date stamp castings used for coupling housings, fittings, and valve bodies for quality assurance and traceability.
- C. Valves: Bearing product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- D. Products:
 - 1. Listed, classified, and labeled as suitable for the purpose specified and indicated.
 - 2. Refer to UL (DIR).
- E. Perform Work in accordance with local authorities having jurisdiction, municipality, and water utility requirements.

1.05 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.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

1.07 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.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Ductile Iron Pipe: Listed, AWWA C104/A21.4:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- B. PVC Pipe: Listed, AWWA C900 Class 100:
 - 1. Fittings: AWWA C111/A21.11, cast iron.
 - 2. Joints: ASTM D3139 compression gasket ring.

2.02 VALVES

- A. General:
 - 1. Manufacturer's name and pressure rating marked on valve body.
 - 2. Minimum Compliance: UL (DIR) listed and labeled.
 - 3. Maximum Inlet Pressure: 400 psi.
 - 4. Maximum Service Temperature: 180 degrees F.
 - 5. Valve Coatings:
 - a. Internally: 4 mils, 0.004 inch epoxy, minimum.
 - b. Externally: Epoxy base then fire red enamel paint or heat-fused red epoxy paint.
- B. Detector Check Valve, Flanged End:
 - 1. Manufacturers:
 - a. Ames Fire and Waterworks: www.amesfirewater.com.

- b. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. 4 inch NPS to 10 inch NPS:
 - a. Construction:
 - 1) Body: Constructed of heavy steel, 300 series stainless steel, or ASTM A536 ductile iron to AWWA C550, as applicable.
 - 2) Coating: Fusion bonded epoxy in accordance with AWWA C550.
 - 3) Spring and Linkage: Stainless steel.
 - 4) Removable Clapper Seat Ring: Bronze.
 - 5) Seat: ASTM B63 bronze.
 - 6) Maximum Working Pressure: 175 psi.
- C. Double Check Detector Valve Assembly, Flanged End:
 - 1. Manufacturers:
 - a. Ames Fire and Waterworks: www.amesfirewater.com/#sle.
 - b. Deringer
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. 2-1/2 inch NPS to 10 inch NPS:
 - a. Construction:
 - 1) Body: 300 Series stainless steel or ASTM A536 Grade 65-45-12 ductile iron.
 - 2) Two independently operating, spring-loaded, check valves.
 - 3) Two OSY resilient seated gate valves.
 - 4) Bypass Assembly:
 - (a) Bypass Line: Hydraulically sized to accurately measure low flow.
 - (b) Double check including shut-off valves, and required cocks.
 - (c) Meter with _____ gal readout.
 - 5) Cam-Check:
 - (a) Internally loaded, providing positive, drip-tight closure against reverse flow.
 - (b) Stainless steel cam arm and spring, rubber-faced disc, and replaceable, thermoplastic seat.
 - 6) Valve Cover:
 - (a) Provides access to all internal parts.
 - (b) Held in place through the use of a single grooved style two-bolt coupling.
- D. Reduced-Pressure Zone (RPZ) Device, Flanged End:
 - 1. Manufacturers:
 - a. Ames Fire and Waterworks: www.amesfirewater.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. 2-1/2 inch NPS to 10 inch NPS:
 - a. Construction:
 - 1) Main Valve Body: ASTM A536 Grade 65-45-12 ductile iron, 300 Series, stainless steel, or 304 Series, stainless steel
 - 2) Relief Valve Body: ASTM A536 Grade 65-45-12 ductile iron, 300 Series stainless steel, or 304 Series stainless steel
 - 3) Coating (As Applicable): Fusion epoxy internal and external, AWWA C550.
 - 4) Shutoff Valves: NRS resilient wedge gate valve, AWWA C509.
 - 5) Check Seats: Stainless steel.
 - 6) Disc Holder: Stainless steel.
 - 7) Elastomer Disc: Silicone, PPE/polystyrene, EPDM, or Buna-N.
 - 8) Spring: Stainless steel.
 - 9) Inlet/Outlet Flow:
 - (a) Inlet:
 - (1) Orientation: Horizontal.
 - (2) Flow Direction: Up.

- (b) Outlet:
 - (1) Orientation: Vertical.
 - (2) Flow Direction: Horizontal.

2.03 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2316.13.
- B. Cover: As specified in Section 31 2316.13.

2.04 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.
- B. Supervisory Switches: See Section 21 1300 for waterflow and supervisory switches.
- C. Tracer Wire:
 - 1. Provide magnetic, detectable conductor with clear plastic covering and imprinted with "Water Service" in large letters.
 - 2. Conductor to be of sufficient length to be continuous over each separate run of nonmetallic pipe.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. Earthwork: Perform earthwork operations in accordance with Sections 31 2316, 31 2316.13, and 31 2323.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide ____ sq feet thrust restraint bearing on subsoil.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION

- A. General Requirements:
 - 1. Location of Water Lines:
 - a. Terminate the work covered by this Section at a point approximately 5 feet from the building unless indicated otherwise.
 - b. Do not install water line closer horizontally than 10 feet from any sewer line unless indicated otherwise.
 - c. Water Piping Parallel With Sewer Piping:
 - 1) Install water piping minimum 10 feet horizontally (measured edge-to-edge) from a sewer or sewer manhole where possible.
 - 2) Bottom (Invert) of Water Piping:
 - (a) Minimum 18 inches above top (crown) of sewer piping.
 - (b) Where this vertical separation of 18 inches above top (crown) of sewer piping cannot be obtained, the installation will be acceptable only when

sewer piping is constructed of AWWA approved water pipe and pressure tested in place without leakage prior to backfilling.

2. Sleeving:
 - a. Sleeve water piping where piping is required to be installed within 3 feet of existing structures.
 - b. Provide ductile iron or Schedule 40 steel sleeves.
 - c. Fill annular space between pipe and sleeves with mastic.
 - d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.
 3. Pipe Laying and Jointing:
 - a. Remove fins and burrs from pipe and fittings.
 - b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
 - c. Provide proper facilities for lowering pipe sections into trenches.
 - d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
 - e. Cut pipe in a neat, workmanlike manner accurately to length established at the site and work into place without forcing or springing.
 - f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 - g. Wedging or blocking between bells and spigots will not be permitted.
 - h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
 - i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
 - j. Support piping at proper elevation and grade.
 - k. Secure firm, uniform support.
 - l. Wood support blocking will not be permitted.
 - m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 - n. Provide anchors and supports where indicated and necessary for fastening work into place.
 - o. Provide proper provisions for expansion and contraction of pipelines.
 - p. Keep trenches free of water until joints have been properly made.
 - q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each workday.
 - r. Do not install pipe during unacceptable trench conditions or inclement weather.
 - s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet.
 4. Tracer Wire:
 - a. Install continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 - b. Attach wire to top of pipe securely to prevent displacement during installation.
 5. Connections to Existing Water Lines:
 - a. Ensure minimal interruption of service on the existing line.
 - b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
 6. Penetrations:
 - a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
 - b. Fill annular space between sleeves and walls with rich cement mortar.
 - c. Fill annular space between pipe and sleeves with mastic.
- B. Special Requirements:
1. Ductile Iron Piping:

- a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements".
 - b. Jointing:
 - 1) Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 - 2) Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.
 - 3) Make flanged joints with the gaskets, bolts, and nuts specified for this type joint.
 - (a) Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories and equipment.
 - (b) Align bolt holes for each flanged joint.
 - (c) Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
 - (d) Do not allow adjoining flange faces to be out of parallel to such a degree that the flanged joint cannot be made watertight without over-straining the flange.
 - (e) When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions.
 - (f) Use set-screwed flanges to make flanged joints where conditions prevent the use of full length, flanged pipe and assemble in accordance with the recommendations of the set-screwed flange manufacturer.
 - c. Allowable Deflection:
 - 1) Maximum Allowable Deflection: As stated in AWWA C600.
 - 2) If the alignment requires deflection in excess of the above limitations, furnish special blends or a sufficient number of shorter pipe lengths to provide angular deflections within the limit set forth.
 - d. Pipe Anchorage:
 - 1) Provide concrete thrust blocks (reaction backing), for pipe anchorage except where metal harness is indicated.
 - 2) Thrust blocks to comply with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks to be as indicated.
 - 3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
 - 4) Provide metal harness in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as indicated in NFPA 13, except as otherwise indicated.
 - e. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.
2. PVC Plastic Piping:
- a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements"; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23.
 - b. Jointing:
 - 1) Push-On Joints:

- (a) Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
 - (b) For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 - (c) For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 - (d) Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
 - (e) Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23 for pipe joint assembly.
 - (f) Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly.
- c. Offset: Maximum offset in alignment between adjacent pipe joints to be as recommended by the manufacturer and approved by the Engineer, not to exceed 5 degrees.
- d. Pipe Anchorage:
 - 1) Provide concrete thrust blocks (reaction backing) for pipe anchorage, except where metal harness is indicated.
 - 2) Provide thrust blocks in accordance with the requirements of AWWA C605 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks to be as indicated.
 - 3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
 - 4) Provide metal harness as indicated.
- e. Fittings: Install in accordance with AWWA C605.
- C. Valves:
 - 1. Set valves on solid bearing.
 - 2. Center and plumb valve box over valve.
 - 3. Set box cover flush with finished grade.

3.05 SERVICE CONNECTIONS

- A. Provide fire water service to Local Authority Having Jurisdiction requirements with reduced pressure backflow preventer and water meter with by-pass valves.
- B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Caulk enlarged sleeve watertight.
- C. Anchor fire service main to interior surface of foundation wall.
- D. Provide 18 gauge, 0.0478 inch galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for 2 inches minimum of glass fiber insulation stuffing.

3.06 FIELD QUALITY CONTROL

- A. Field Tests and Inspections:
 - 1. See Section 01 4000 - Quality Requirements for additional requirements.

2. Provide all labor, equipment, and incidentals required for field testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01 5100 - Temporary Utilities.
3. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete.
4. Fill pipeline 24 hours before testing and apply test pressure to stabilize system, using only potable water.
5. Pressure test piping to ____ psi.
6. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
7. Prepare reports of testing activities.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstrate proper operation of equipment to Owner's designated representative.
- B. Training: Train Owner's personnel on operation and maintenance of system.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Provide minimum of two hours of training.

END OF SECTION

SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System design, installation, and certification.
- B. Fire department connections.

1.02 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 1963 - Standard for Fire Hose Connections; 2019.
- D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- E. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Engineer.
- C. Closeout Documents:
 - 1. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
 - 2. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - b. Sprinkler Wrenches: For each sprinkler type.
 - 3. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.04 QUALITY ASSURANCE

- A. Comply with FM (AG) requirements.
- B. Designer Qualifications: Design of the system including all shop drawings, calculations, and other submittals shall be completed by a technician with a minimum NICET Level III certification or by a registered Professional Engineer who has passed the NCEES professional engineering exam for fire protection and is licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience and approved by manufacturer.
- E. Equipment and Components: Provide products that bear FM (AG) label or marking.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Deringer
 - 2. Tyco Fire Protection Products: www.tyco-fire.com.
 - 3. Viking Corporation: www.vikinggroupinc.com.
 - 4. Victaulic
 - 5. Reliable Automatic Sprinkler Co.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Provide fire department connections where indicated.
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

- A. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Chrome plated.
 - 4. Cover Plate Finish: White.
 - 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Hard Ceiling Type: Concealed pendant type.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Chrome plated.
 - 4. Cover Plate Finish: White.
 - 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- C. Exposed Area Type: Pendant type.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- D. Heads in corrosive environments: I.E. swimming pools, etc.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Stainless Steel
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - 5. Guard: Inline SprinkGAURD powder coated steel.
- E. Head Guards: Finish to match sprinkler finish. Provide for gymnasiums, hockey rinks, fitness and recreation centers and rack storage areas.
 - 1. Provide head guards in gymnasiums, mechanical rooms, near shelving and other areas subject to damage.
 - 2. Inline SprinkGAURD powder coated steel.

- F. Flexible Drop System: Stainless steel, multiple use, open gate type.
 - 1. Application: Use to properly locate sprinkler heads.
 - 2. Include all supports and bracing.
 - 3. Provide braided type tube as required for the application.
 - 4. Manufacturers:
 - a. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 PIPING SPECIALTIES

- A. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
- B. Test Connections:
 - 1. Inspector's Test Connection for Preaction Systems:
 - a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
 - b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
 - c. Supply discharge orifice with same size as corresponding sprinkler orifice.
 - d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.
 - 2. Backflow Preventer Test Connection:
 - a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
 - b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
 - c. Provide permanent sign reading "Test Valve" in accordance with Section 21 0553.
- C. Electric Alarm: UL listed audible strobe with 3 selectable dBA settings NEMA 4x rated for outdoor installations. Wired to flow and/or pressure switch on sprinkler zone piping. Provide switching relay for multiple zone valve input.
- D. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- E. Fire Department Connections:
 - 1. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
 - a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
 - b. Configuration: Horizontal.
 - c. Outlet: With pipe threads, 4 NPS.
 - 1) Location: Back.
 - d. Finish: Brass or bronze.
 - e. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
 - f. Manufacturers:
 - 1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Provide approved backflow preventer assembly at sprinkler system water source connection.

- D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- E. Place pipe runs to minimize obstruction to other work.
- F. Place piping in concealed spaces above finished ceilings.
- G. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- H. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- I. Flush entire piping system of foreign matter.
- J. Install guards on sprinklers where indicated.
- K. Hydrostatically test entire system.
- L. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 22 0060 - PLUMBING & PIPING DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Contract documents and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections apply to this section.
- B. This section specifies the demolition and removal of all plumbing equipment and distribution conduits including but not limited to air outlets, piping, insulation, plumbing fixtures and accessories in existing building.
- C. Unless otherwise noted in the Documents, all salvage items removed in connection with this Contract are to become the property of the Contractor, however the Owner shall have the first right of refusal on all equipment removed.

1.02 SUBMITTALS

- A. Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- B. Schedule of selective demolition activities:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of building utility services.
 - 3. Coordination for shutoff, capping and continuation of services.
 - 4. Coordination of Owner's continued occupancy of portions of existing building and of Owner's occupancy of completed work.
- C. Pre-demolition photographs or videotape showing existing pre-demolition conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before demolition work begins.

1.03 PROJECT CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct demolition so Owner's operation will not be disturbed. Provide not less than 48-hour notice to Owner of activities that will affect the Owner's operations.
- B. Maintain existing services to Owner occupied areas during demolition if possible or coordinate interruption of services prior to demolition.
- C. Owner assumes no responsibility for condition of area to be selectively demolished.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- E. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and existing ductwork and piping arrangements are as shown on Drawings.

- B. Verify that abandoned equipment serves only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
The demolition Drawings are diagrammatic and show the general scope of demolition work and do not show all the construction detail of the original record drawings. Report discrepancies to the Project Engineer before disturbing existing installation.
- D. The Contractor shall visit the existing building and grounds and review the existing building record drawings for details of existing installation to familiarize themselves with existing conditions prior to submitting bid. No allowance will be made subsequently, in this connection, on behalf of the Contractor for any error or negligence on his part.
- E. Beginning of demolition means the Contractor accepts existing conditions.

3.02 PREPARATION

- A. Disconnect mechanical systems in areas scheduled for removal. Notify Project Engineer and Owner of areas to be affected by mechanical demolition work prior to commencing.
- B. Disconnect utilities in areas scheduled for removal. Notify Project Engineer and Owner of areas to be affected by plumbing demolition work prior to commencing.

3.03 SELECTIVE DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and remove from site and extend existing mechanical work under provisions of this Division and as indicated on the Drawings unless otherwise noted.
- B. Salvage items noted to remain the property of the Owner shall be delivered to a location to be designated by the Owner. Contractor shall remove from construction areas all trash or debris as it accumulates and dispose of it off site at no additional cost to the Owner. All construction areas shall be kept clean, safe, and orderly at all times. At the completion and acceptance for work, Contractor shall remove from the site all debris and surplus materials resulting from this work and dispose of them off site at no additional cost to the Owner.
- C. Do not use cutting torches until work area is clear of flammable materials. At concealed spaces verify condition and contents of hidden space before starting flame cutting operations. Maintain Fire Watch and portable fire-suppression devices during flame-cutting operations. Maintain and evaluate ventilation during flame-cutting operations.
- D. Maintain ventilation for dust control during selective demolition process. Verify Owner requirements for dust control and conform to their standards for all demolition activities.
- E. Remove, relocate, and extend existing installations to accommodate new construction as required for proper installation and system operation.
- F. Remove all accessories above grade. When removing equipment or terminal devices all associated pipe, etc. shall be removed and capped as required. Cut piping, tubing, etc. behind walls, above ceilings and below floors, and patch surfaces to match existing conditions. Finishes will be by others unless otherwise noted in documents.
- G. Fill all abandoned waste lines below floor slabs with low stress grout.
- H. Neatly cut openings and holes plumb, square and true to dimension required. Use cutting methods least likely to damage construction to remain or adjoining construction. Cut and drill from exposed surfaces into concealed surfaces to avoid marring or spalling of finished surfaces. Temporarily cover openings to remain.
- I. Patch all openings created by removal of mechanical equipment, ATC devices, ducts, pipes, etc. unless noted as being patched by others. Openings to be patched to match existing with similar materials and finish unless otherwise noted.
- J. Seal all existing roof penetrations, which will not be reused. Roof patching shall be by project roofing contractor, or an Owner approved roofing contractor.
- K. Remove, relocate, or provide brackets, hangers, and other accessories as required.

- L. Repair adjacent construction and finishes damaged during demolition and extension work.
- M. Maintain access to existing mechanical installations, which remain active.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment, which remain or are to be returned to the Owner.
- B. All building surfaces damaged and openings left by new Work or the removal or relocation of mechanical equipment, piping, etc., shall be repaired to original condition and painted by the Contractor.

END OF SECTION

SECTION 22 0100 - PLUMBING GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 APPLICABILITY

- A. This section applies to and forms a part of each of the sections of Division 22. This section, and each of the sections to which it applies, is subject to the requirements of the Instructions to Bidders, General Conditions, and Special Conditions of these complete specifications.
- B. The work covered by this Division of the Specifications consists of furnishing all labor, supervision, equipment, materials, all incidentals, related items, and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.
- C. Only such items as are hereinafter specified or indicated on the drawings to be furnished by others, shall be considered to be furnished by others. All other items are to be considered as a part of this Contract and shall be so bid.
- D. The omission of specific reference to any parts necessary to, or reasonably incidental to, a complete installation shall not be construed as releasing the Contractor from furnishing and installing same.
- E. All work shall be finished, tested and ready for operation.

1.02 DEFINITIONS

- A. Word "Furnish" where written in Division 22 specifications and drawings shall mean Contractor shall deliver to the site item(s) specified, as well as additional specialized materials and/or accessories necessary for the use and operation of item or items specified.
- B. Word "Install" where written in Division 22 specifications and drawings shall mean Contractor shall set in position, connect (including sub-assemblies furnished), and adjust for use. Contractor shall furnish miscellaneous specialty items such as hangers, valves, unions, piping, sheet metal, etc., as obviously necessary for a complete and operating installation.
- C. Word "Material" where written in Division 22 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.
- D. Word "Labor" where written in Division 22 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment, and services to carefully assemble, install and affix all material in a proper, complete, and acceptable manner.
- E. Word "Provide" where written in Division 22 specifications and drawings shall mean "Mechanical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".

1.03 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

- A. Notify the Engineer of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.
- B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.
- C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.
- D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished, and installed.
- E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material

is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.

- F. Any work not clear to Contractor shall be referred to Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Engineer, whose decision is final, without additional charges.
- G. By virtue of submitting a bid, Contractor agrees that he is skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that he has carefully reviewed all drawings, all specifications, and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

1.04 DRAWINGS

- A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, connections, and accessories which may be required. Furnish offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.
- B. All piping and ductwork shall be routed so as not to obstruct access to other equipment (i.e. VAV box controls, electrical devices, fire alarm devices, etc.). Routing indicated on drawings is representative of intended location but shall be field verified. It shall be this contractor's responsibility to coordinate with other trades for accessibility.
- C. Any work or system on the roof not explicitly indicated on the roof plan shall be approved by the engineer prior to installing.
- D. In general, the mechanical equipment drawings are drawn to scale as noted. Obtain dimensions and locations of partitions, walls, etc., from the Architectural drawings wherever possible and do not scale the mechanical drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.
- E. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.05 SITE INSPECTION

- A. Before submitting a proposal for the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize himself with all the existing conditions and limitations, including the extent of demolition, cutting, and patching to be done by the Contractor for Mechanical Work. No extras will be allowed because of the Contractor's misunderstanding as to the amount of work involved, or his lack of knowledge of any condition in connection with the work.

1.06 PRIOR APPROVAL REQUESTS

- A. Where the Bid Documents stipulate a particular Product, substitutions will be considered by the Engineer up to 10 days before receipt of bids.
- B. The submission shall provide complete information, test, etc. relating to quality, performance, suitability, to determine acceptability of such products.
- C. When a request to substitute a Product is made, the Engineer may approve the substitution and will issue an Addendum to known bidders.
- D. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.

- E. The cost of any changes of other trades as a result of use of the substitution material or equipment must be borne by the Contractor submitting such material or equipment.

1.07 REVIEW OF MECHANICAL MATERIALS AND EQUIPMENT

- A. Within thirty (30) days after award of construction contracts, Contractor shall submit for acceptance to the Architect quantity of shop drawings specified for the equipment indicated in these specifications. The shop drawings shall include the equipment manufacturer's name and address, catalog designation or model number, rough-in data & dimensions, performance curves and rated capacities & operational characteristics.
- B. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to submittal. Each shop drawing set shall be stamped, signed, and dated indicating Contractor review and submitted electronically via PDF file format. The PDF file name shall include the relevant specification section number for reference. If the Contractor fails to properly review shop drawings, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.
- C. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.
- D. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.
- E. The Engineer will review all Shop Drawings submitted and will retain a copy for record file.
- F. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:
 - 1. "No Exception Noted" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at his discretion, may with fabrication and/or procurement and installation.
 - 2. "Make Corrections Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time.
 - 3. "Revised and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at his discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
 - 4. "Rejected" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.
- G. If the Engineer rejects (Revised and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews. Any subsequent submittal will require the inclusion of a check made out to the engineer in the amount of \$ 500.00. Contractor is responsible for all delays caused by the resubmittal process.
- H. Should the contractor fail to comply with any of the requirements of the preceding sub-paragraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.

- I. When the contractor chooses to furnish and reviewed material or equipment that requires electrical specifications/connections (circuit breaker, conduit, wire, labor, etc.) different than shown and/or scheduled on the drawings, or specified in detail, the contractor shall be responsible for coordinating any necessary changes and shall bear the cost of such changes (including engineering costs).

1.08 PROPOSAL REQUESTS AND INSTRUCTIONS

- A. For any proposal request or instruction that requires an adjustment to the Contract Sum, submit an itemized quotation for the change(s) described in the proposed modifications to the Contract Documents. Proposal shall also indicate credits, deducts, and/or offsets for material and labor originally included in contract.
 1. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. Breakdown shall include amounts, lengths, quantities, types, sizes, etc. of material.
 2. Indicate applicable taxes, O&P, delivery charges, equipment rental, and other incidental charge.
 3. Include costs of labor and supervision directly attributable to the change.
 4. All sub-contractor pricing shall include the same breakdown as described above.

1.09 WARRANTY

- A. All equipment and installation shall be provided with a 1-year warranty beginning with substantial completion.
- B. Refer to individual spec sections for specific warranty information that is different than stated above.
- C. Submit warranty with related forms completed in Owner's name and registered with manufacturer.

1.10 MANUALS

- A. In addition to catalog data and shop drawings submitted for review, this contractor shall furnish two (2) final Operation and Maintenance Manuals for the mechanical systems. Manuals shall be delivered to the Architect before final observation of the work.
- B. Operation and Maintenance Manuals shall be furnished in PDF electronic format as well as two (2) copies bound in new hard backed 3 ring binders with the title "Operations and Maintenance Manuals" and the project title clearly printed on the front cover and side of binder .
- C. Provide an index at the beginning of the manual for the sections included in the manual.
- D. All sections in hard copy manuals shall be referenced with plastic tabs.
- E. Include at the front of the manual a complete listing of the Architect, Engineer and contractors and sub-contractors used on the project. Listing shall include names, addresses and phone numbers for each.
- F. Manuals shall be arranged in order similar to the specifications. All major pieces of equipment shall be referenced with tabs. At the beginning of each section, the equipment supplier's name, address, and phone number shall be provided.
- G. Data for equipment included in the manuals shall include:
 1. Approved shop drawings clearly showing the models, sizes and capacities of equipment used.
 2. Operations Manuals detailing step by step procedure to follow putting the equipment into operation.
 3. Maintenance Manuals from the manufacturer of each piece of equipment including instructions on installation, maintenance, and lubrication. Manuals shall include parts lists for all replacement parts.

- H. The following items shall also be included in the manuals for the Owners information: Factory start-up reports, Valve Tag list, and Signed owner instruction forms for all items specified as requiring owners instruction
- I. Operations and Maintenance Manuals shall be submitted to the Engineer for approval prior to delivery to the Architect.

1.11 INSTRUCTION OF OWNER'S EMPLOYEES

- A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.
- B. An Operating and Maintenance Manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- C. The number of man hours of instruction furnished for each system shall be as specified below. Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 75% of time used for an initial instruction and 25% of time used for a follow up instruction, a minimum of four (4) weeks after initial instruction.
- D. "Instruction of Owner's Employees" form at end of section shall be filled out and signed by Contractor and Owner's Representative and three (3) signed copies of form sent to Engineer.
- E. Owner training and instructions:
 - 1. Plumbing systems including but not limited to water heaters, sump pumps and controls, plumbing fixtures, and ____ shall not be less than four (4) man hours.

1.12 MECHANICAL LIST OF CONSTRUCTION CLOSEOUT DOCUMENTS

- A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed in Appendix 'A' at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an N/A where items don't pertain.

1.13 INSTALLATION OF EQUIPMENT

- A. All equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications. Auxiliary piping, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.
- B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.

1.14 RECORD DRAWING

- A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.
- B. The contractor shall note on the record drawings the elevations and/or inverts of water service where it exits the building foundation.

1.15 COOPERATION WITH OTHER TRADES

- A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

1.16 INSPECTION OF SITE

- A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themselves with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.17 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

- A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.18 CODES, ORDINANCES, REGULATIONS & STANDARDS

- A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.
- B. All work shall conform to applicable state and local codes, ordinances, regulations and/or standards.

1.19 PERMITS AND LICENSES

- A. This contractor shall obtain and pay for all licenses and permits and shall pay for all fees and charges for the connection to outside services and use of property other than the site of the work for storage of materials or other purposes.
- B. Contractor shall coordinate and request all inspections from authority having jurisdiction. The Contractor shall notify the Architect of all such coordinated inspections (date & time) and shall submit certificates of inspection and final approval of the local inspection authority.

1.20 TESTS

- A. Test all equipment installed under these specifications and demonstrate its proper operation to the Engineer.
- B. Do not test or operate equipment for any purpose, until it has been fully lubricated in accordance with the manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to the piping system with sufficient water so that it will not run dry.
- C. All testing shall be completed before final inspection, and test results shall be available during the final inspection.

1.21 GUARANTEES

- A. This contractor shall guarantee all equipment, material, and workmanship for a period of one year from date of final certificate. Any defects in mechanical equipment, workmanship or materials that appear, or cause trouble of any kind within a period of one year from date of final certificate shall be remedied, free of charge. Refer to other sections of these specifications for guarantees in excess of the requirements herein described.

1.22 CONSTRUCTION CLOSEOUT DOCUMENTS

- A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an NA where items don't pertain.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 INSTRUCTION TO OWNER'S EMPLOYEES FORM:

DATE _____

INSTRUCTION OF OWNER'S EMPLOYEES

This letter shall certify that the Contractor has furnished the Owner with full instructions in the care and operation of all parts of the plumbing system as specified under Section 22 0100 paragraph entitled "Instruction of Owner's Employees".

Owner's Initial Instructions				Owner's Follow-up Instructions		
Section	Hours	Date	Initials	Hours	Date	Initials
Special Piping Systems						
Plumbing						
Contractor						
Owner's Representative						

3.02 LIST OF CONSTRUCTION CLOSEOUT DOCUMENTS

<u>DIVISION</u>	<u>DOCUMENT</u>	<u>DATE / INITIALS</u>	<u>APPROVED</u>
22 00 00	Record drawings - Plumbing		
22 00 00	O&M Manuals - Plumbing		
22 00 00	Owners Instruction - Plumbing		

END OF SECTION

SECTION 22 0150 - PLUMBING & PIPING MATERIALS & METHODS

PART 1 GENERAL

1.01 APPLICABILITY

- A. This section covers basic materials and methods and applies to and forms a part of each of the sections of Division 22.
- B. This work shall be in accordance with this and other applicable sections and/or provisions of these specifications and with the applicable drawings.

1.02 MATERIALS & MANUFACTURERS

- A. All materials and equipment shall be new, free of defects, installed in accordance with manufacturer's current published recommendations in a neat manner and in accordance with standard practice of the industry.
- B. Certain materials and/or equipment in this specification are specified by manufacturer and catalog numbers. The design was based on the specified equipment and establishes a degree of quality, performance, physical configuration, etc. If the contractor should elect to use equipment other than the equipment used as a basis for design but listed as "acceptable" in the specifications, he shall be responsible for space requirements, configuration, performance, and changes in bases, supports, vibration isolators, structural members, openings in structure and other apparatus that may be affected by its use.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 COORDINATION OF OPENINGS

- A. This contractor shall coordinate all openings required for new piping, equipment, controls, etc. through any structural slabs, beams, or walls. Contractor shall request a copy of the precast concrete shop drawings and verify locations and sizes of all openings required.
- B. All costs associated with structural field changes or redesigns of the building systems due to lack of field coordination shall be responsibility of this contractor.

3.02 PIPE AND FITTING INSTALLATION

- A. Plastic DWV piping shall be installed as addressed by IAPMO (UPC) code section on Expansion and Contraction. Any straight runs of plastic DWV piping exceeding 30 feet shall be installed to accommodate thermal expansion.
- B. Piping is to be installed as shown on the drawings as much as practical. When a pipe size is not indicated, the subcontractor shall request the pipe size from the Architect through the Plumbing Contractor.
- C. Provide sufficient swing joints, expansion loops, and/or devices necessary and install so as to permit free expansion and contraction of piping without causing undue stresses. Make all changes in direction with fittings. Support piping independently at all equipment so that its weight shall not be supported by the equipment.
- D. Install piping without springing or forcing and clear all windows, doors, and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted.
- E. All pipes shall be reamed to full pipe diameter before joining.
- F. Install vertical risers plumb and straight, horizontal lines parallel with walls and partitions. Conceal piping above ceilings and within furring and/or walls when practical.
- G. Provide shut-off valves and unions suitably located to isolate each item of equipment, branch circuit or section of piping.

- H. Provide 1/2" drain valves at all low points of each system to enable complete drainage.
- I. Provide "Clearflow" dielectric waterways at all junctions of dissimilar metals in potable water systems.
- J. All piping shall be adequately supported from the building structure with adjustable hangers to maintain uniform grading where required and to prevent sagging or pocketing.
- K. Provide supports between piping and building structure where necessary to prevent swaying.
- L. The use of wire or perforated metal to support pipe will not be permitted.

3.03 PROTECTION, DELIVERY AND STORAGE OF MATERIALS

- A. Make provisions for the delivery and storage of materials and make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Protect materials and equipment stored on site from weather and moisture by maintaining factory covers and/or suitable weather-proof coverings. For extended outdoor storage, motors shall be removed from equipment and stored separately.
- C. The open ends of all piping shall be covered whenever that system is not being worked on, i.e. end of the workday, completion of a section, etc. Covering shall keep dust, garbage, vermin, and other foreign objects out of the piping when the contractor is not on the jobsite.

3.04 CUTTING AND REPAIRING

- A. All holes and penetrations required for the installation of the plumbing equipment shall be by the plumbing contractor. This shall include all piping, ductwork, and any other penetration through the wall, floor, or roof.
- B. Cutting construction shall be done only with the written permission of the Architect. Cutting shall be done carefully and damage to buildings, pipes, wiring, or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional charge to the Owner. This Contractor shall be responsible for all cutting and patching unless such work has been delegated to the General Contractor.
- C. All holes cut into concrete shall be cut by means of power saws or core drills. All unsightly spalls or chips shall be repaired.
- D. All openings remaining around duct and pipe penetrations shall be filled, caulked, and painted to match wall. Code approved fire caulking shall be used for all rated penetrations.

3.05 SEALING FLOOR, CEILINGS AND WALL OPENINGS

- A. Where pipes pass through walls, ceilings, floors, or partitions, (other than those through fire rated walls or chases) the opening in the construction around the pipe shall not exceed ½ inch average clearance on all sides and shall be sealed to prevent the passage of sound and air. Coordinate wall openings to allow insulation thickness to pass through walls if allowed.
- B. The material used to seal space between the wall and the pipe shall be non-combustible caulk type, or wrap type, as conditions require. Provide sheet metal angles or flanges as may be required to contain the stopping material. Use of expanding foam will be allowed if surfaces are cleaned of an excess material and all edges are trimmed smooth. Penetrations through exterior walls shall be sealed weather tight.
- C. Special attention shall be given to penetrations of mechanical room walls. Fill gaps around entire exterior area of the pipes with sound insulation (batt or mineral wool) to within ½" of the wall surface. Use silicone caulking to finish filling the opening smooth with the wall surface or provide sheet metal angles. All sealer shall meet flame spread 25 and smoke developed less than 50.
- D. Where pipes pass through fire-rated walls, ceilings, floors, vertical service shafts walls, or partitions, the opening in the construction around the pipe or duct shall be fire-stopped to prevent the passage of flame and smoke. All assemblies shall be UL or ASTM listed to provide

a fire rating equal to that of the construction being penetrated. For the firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests shall be submitted from the manufacturer to the local authorities having jurisdiction for their review and approval prior to installation. Individuals installing the firestopping shall be experienced and certified as required by the manufacturer whose product is being applied. Refer to firestopping spec section for reposition finned element to be centered under windows as required. more information.

- E. Manufacturer's assembly drawings shall be provided in O & M Manuals for each type of penetration. Printed metal or plastic labels shall be permanently applied on the structure within 6" of the edge of the firestop system. Metal labels shall be applied with mechanical fasteners & plastic labels shall be the self-adhering type with adhesive capable of permanently bonding labels to the surfaces on which the labels are placed. The information required on the label include UL/ASTM assembly number, date of installation, fire stopping material manufacture name, Contractor's name, address & phone number & the installer's name.
- F. Acceptable manufacturers shall be Hilti, 3M Brand, or a prior approved product.

3.06 CLEANING AND PAINTING

- A. Clear away all debris, surplus materials, etc., resulting from work or operations, leaving the job and equipment furnished under this contract in a clean condition.
- B. All equipment being furnished with finished paint coat shall be examined upon job completion for scratches and other surface damage. All finished surfaces where necessary shall be touched up with touch-up paint of color to match the factory finish.
- C. Paint all exposed bare pipe exterior of the building. Bare pipe shall be painted one coat of No. 7769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Final coat shall be of a color selected by the architect.
- D. Paint all exposed iron and steel work, pipe hangers, pipe stands, uninsulated tanks, supporting steel for equipment and exposed bare pipe in mechanical areas. Iron and steel work and bare pipe shall be painted one coat of No. 4769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Iron and steel work shall be painted black.
- E. Refer to Section 09, Painting for additional requirements.

3.07 ASBESTOS FREE BUILDING

- A. There shall be no products or building materials used as a temporary or permanent element in the construction of this building, which has in its make-up any form of asbestos. The contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building and remind material suppliers that their products must be asbestos free.
- B. Notify the Architect immediately of any existing materials which are suspected of containing asbestos. Do not disturb or attempt to remove any asbestos containing material. The Architect will contact the Owner and inform them of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos removal.

3.08 HOUSEKEEPING PAD FOR MACHINERY (BY MECHANICAL)

- A. Housekeeping Pad Sub-bases shall be provided for all machinery such as water heaters, pumps, and/or where called out on plans.
- B. Housekeeping pads shall be a minimum of 4-inches thick and shall follow all manufacturer's instructions and requirements for support.

3.09 SALVAGE

- A. All items removed from existing building shall be salvaged in a workmanlike manner.

- B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

END OF SECTION

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water meters.
- B. Flow meters.
- C. Pressure gauges.
- D. Thermometers.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2025).
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).
- D. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2024.
- E. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Utility Service Metering: Coordinate and apply Utility Service Provider requirements in terms of meter type, size, physical location, pipe size, upstream/downstream pipe lengths required, and other installation details.

1.04 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.
- C. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.01 LIQUID METERS

2.02 FLOWMETERS (FMD)

- A. Manufacturers:
 - 1. Gerand Engineering: www.gerand.com
 - 2. Flow Design
 - 3. Griswold
 - 4. K.G.
 - 5. Nexus
 - 6. Tour & Andersson
 - 7. Red White Valve Corp.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flow meter fittings on water recirculation lines 1/2" thru 1-1/2" shall be calibrated orifice type with integral tamperproof valve. Flowmeter shall be provided with quick connect couplings. Valves shall be provided with stem extension and port extensions as required for insulation thickness applied.

- C. Orifice type flowmeter shall have an accuracy of not less than plus or minus 1 percent of actual flow. Orifice type flowmeter shall have a pressure drop at indicated flow not exceeding 25 inch of water column.

2.03 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Trerice: www.trerice.com.
 - 3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 - 4. Omega Engineering, Inc: www.omega.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Pressure Gauges: ASME B40.100 metal case, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Stainless Steel.
 - 2. Dial Text and Markings: Black color on white background with scaled kPa and psi units.
 - 3. Accuracy: ASME B40.100, adjustable commercial grade (B) with 2 percent at mid-range of span.
 - 4. Scale: Psi.
 - 5. Size: 4-1/2 inch diameter.
 - 6. Gauge Wetted Materials: Stainless steel case and stainless steel socket rated to match process pressure and temperature range.
 - 7. Comply with UL 393 when used for fire protection service or UL 404 when used for compressed gas service.

2.04 THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 - 3. Watts Water Technologies, Inc: www.watts.com/#sle.
 - 4. Weiss Instruments, LLC: www.weissinstruments.com/#sle.
 - 5. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
 - 6. Trerice: www.trerice.com
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. General:
 - 1. Product Compliance: ASTM E1.
 - 2. Lens: Clear polycarbonate, except where stated.
 - 3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.
 - 4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.
- C. Thermometers shall be light powered digital type with solar panels and LCD digits. Thermometers shall be ABS plastic cased and shall be provided with a calibration adjustment.
 - 1. Size: 9 inch case.
 - 2. Window: Clear Lexan.
 - 3. Accuracy: 2 percent, per ASTM E77.
 - 4. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

- A. Socket/Thermowell: Brass separable sockets/thermowell for thermometer stems with or without extensions as required, and with cap and chain.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.
- B. Install flowmeters in accessible locations for adjustment and measurement of device.
- C. Install pressure gauges as follows:
 - 1. At Pumps: Place single gauge before strainer, suction side and discharge side.
 - 2. Include gauge cock to isolate each gauge and extend nipples for insulation clearance.
 - 3. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero.
- D. Install thermometers as follows:
 - 1. Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.
 - 2. Piping: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch to accommodate sockets. Ensure sockets are above insulation clearance.
- E. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

3.02 SCHEDULES

- A. Pressure Gauges, Location and Scale Range:
 - 1. Pumps, 0 to 100 psi.
 - 2. Pressure reducing valves, 0 to 100 psi.
- B. Stem Type Thermometers, Location and Scale Range:
 - 1. Domestic hot water supply and recirculation, 0 to 200 degrees F.

END OF SECTION

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ball valves.
- B. Check valves.

1.02 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- E. ASME B31.9 - Building Services Piping; 2020.
- F. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- G. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.
- H. AWWA C606 - Grooved and Shouldered Joints; 2015.
- I. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
- J. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- K. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Closeout Documents:
 - 1. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- C. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball.
 - 2. Throttling: Ball.
 - 3. Swing Check: Bronze swing check valves with bronze disc.
 - 4. Swing Check (Pump Outlet):
 - a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.
 - b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
- D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- E. Domestic, Hot and Cold Water Valves, low-lead compliant:
 - 1. 2 inch and Smaller:
 - a. Bronze: Provide with solder-joint, threaded, or press-fit ends.
 - b. Ball: Two piece, full port, bronze with stainless-steel trim.
 - c. Bronze Swing Check: Class 125, bronze disc.
 - 2. 2-1/2 NPS to 4 NPS
 - a. Bronze: Provide with solder-joint, threaded, or press-fit ends.
 - b. Ball: Two piece, full port, bronze with stainless-steel trim.
 - c. Bronze Swing Check: Class 125, bronze disc.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 - 1. Hand Lever: Quarter-turn valves 6 NPS and smaller.
- D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
 - 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 - 3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
 - 4. Solder Joint Connections: ASME B16.18.
 - 5. Grooved End Connections: AWWA C606.
- F. General ASME Compliance:
 - 1. Solder-joint Connections: ASME B16.18.
 - 2. Building Services Piping Valves: ASME B31.9.
- G. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- H. Source Limitations: Obtain each valve type from a single manufacturer.

- I. Press-Fit Valve Manufacturers:
 - 1. Watts
 - 2. Viega
 - 3. Milwaukee
 - 4. Apollo
 - 5. NIBCO
- J. Valve manufacturers unless otherwise noted:
 - 1. Apollo
 - 2. Jomar
 - 3. NIBCO
 - 4. Hammond
 - 5. Milwaukee
 - 6. Watts
 - 7. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Stainless Steel trim.
 - 1. WSP Rating: 150 psi.
 - 2. WOG Rating: 600 psi.
 - 3. Body: Forged bronze or dezincified-brass alloy.
 - 4. Ends Connections: Pipe thread or solder.
 - 5. Seats: PTFE.
 - 6. Stem: Stainless steel, blowout proof.
 - 7. Ball: Stainless steel.
 - 8. Operator: Provide lockable handle and stem extension.

2.04 BRONZE, SWING CHECK VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 150: CWP Rating: 300 psig (2070 kPa).
 - 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 - 2. Design: Y-pattern, horizontal or vertical flow.
 - 3. Body: Bronze, ASTM B584
 - 4. End Connections: Threaded.
 - 5. Disc: Bronze.

2.05 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Swing Check: Install horizontal maintaining hinge pin level.
- D. Install check valves at least 5 pipe diameters from pumps or changes in direction.
- E. Provide chainwheels on operators for valves 4 inch NPS and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Underground warning tape.
- E. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide manufacturers catalog literature for each product required.
- C. Closeout Documents:
 - 1. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
 - a. Submit plumbing component identification schedule listing equipment, piping, and valves.
 - b. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
 - c. Valve Data Format: Include id-number, location, function, and model number.
 - 2. Project Record Documents: Record actual locations of tagged valves.
- D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Nameplates:
 - 1. Heat exchangers, water heaters, and other heat transfer products.
 - 2. Control panels, transducers, and other related control equipment products.
 - 3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.
- B. Tags:
 - 1. Piping: 3/4 inch diameter and smaller.
 - 2. Manual operated and automated control valves.
 - 3. Instrumentation, relays, gauges, and other related control equipment products.
- C. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products: www.seton.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: Black.
 - 2. Letter Height: 1/2 inch.
 - 3. Background Color: Green.

4. Nameplate Height: 3/4 inch.

2.03 TAGS

- A. Manufacturers:
 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
 2. Brady Corporation: www.bradycorp.com/#sle.
 3. Brimar Industries, Inc.: www.pipemarker.com/#sle.
 4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 6. Seton Identification Products: www.seton.com.
 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
- C. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.
- D. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.
- E. Piping: 3/4 inch diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.04 PIPE MARKERS

- A. Manufacturers:
 1. Brady Corporation: www.bradycorp.com.
 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products: www.seton.com.
 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Comply with ASME A13.1.
- C. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings. Provide sticker/tape with flow arrows around the circumference of the piping at each end of pipe marker to hold marker in place.
- D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.
- E. Identification Scheme, ASME A13.1:
 1. Primary: External Pipe Diameter, Uninsulated or Insulated.
 - a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
 - b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
 - c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
 - d. 8 to 10 inches: Use 24 inch field-length with 2-1/2 inch text height.
 - e. Over 10 inches: Use 32 inch field-length with 3-1/2 inch text height.
 2. Secondary: Color scheme per fluid service.
 - a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.
 3. Tertiary: Other Details.
 - a. Directional flow arrow band over pipe circumference.

2.05 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 1. Brady Corporation: www.bradyid.com/#sle.
 2. Brimar Industries, Inc: www.brimar.com/#sle.
 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

4. Seton Identification Products: www.seton.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
1. Exception: Use foil-backed detectable type tape where required by serving utility.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil, 0.004 inch.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, 0.005 inch, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
1. Tape for Buried Power Lines: Black text on red background.
 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 CEILING TACKS

- A. Manufacturers:
1. Craftmark: www.craftmarkid.com.
 2. Seton Identification Products: www.seton.com.
 3. 3M
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Steel with 3/4 inch diameter color coded head.
- C. Color code as follows:
1. Plumbing Equipment: Yellow.
 2. Plumbing Valves: Green.

2.07 CEILING IDENTIFICATION TAGS

- A. All plumbing valves shall be denoted with a small engraved tag, attached to the ceiling below the device. The tag shall be white engraved lettering, containing the numbered nomenclature used for the device on the mechanical schedules/drawings.
- B. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products: www.seton.com.
 6. _____.
 7. Substitutions: See Section 01 6000 - Product Requirements.
- C. Markers:
1. Use colored markers with pressure sensitive adhesive on one side.
 2. Make colored markers of plastic, 3/4 to 1 inch in wide by 2-1/2 to 3 inch long.
 3. Use markers of the same size throughout building.
 4. Color Code: Use following color markers for service identification:
 - a. Domestic Water: Valves and Controls - White on Green
 - b. Gas: Laboratory, Medical, Air and Vacuum Valves - Black on White

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. All new piping shall be identified as to contents and direction of flow by stenciling or markers, as specified. Apply where pipes pass through walls (both sides of the wall), at each change of direction and on each 20 feet of straight lengths. For insulated pipe, stencil/marker size shall be based on insulation size, not pipe size.
1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
- B. Piping shall be identified as to contents using the following list. Additional system details shall be included within this specification section.
- | | |
|-------------------------|-------------|
| Cold Water | C.W. |
| 120° F Hot Water | H.W. |
| 140° F Hot Water | 140° H.W. |
| Recirculating Hot Water | R.H.W. |
| Sanitary Drain | SAN. DRAIN |
| Storm Drain | STORM DRAIN |
| Sanitary Vent | SAN. VENT |
- C. Valves controlling mains, risers and branches, but not individual shut-off or local control valves on fixtures and equipment, shall be identified by a metal tag Schedules, framed under glass and mounted where directed, shall be provided showing a complete listing of all valve tags and giving numbers, locations, and color codes, if any, of pipes controlled. Frames shall be secured to wall by not less than four screws. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- D. Install tags in clear view and align with axis of piping.
- E. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- F. Apply ASME A13.1 Pipe Marking Rules:
1. Place pipe marker adjacent to changes in direction.
 2. Place pipe marker adjacent each valve port and flange end.
 3. Place pipe marker at both sides of floor and wall penetrations.
 4. Place pipe marker every 20 feet interval of straight run.
- G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass fiber insulation.
- B. Jacketing and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation: www.jm.com.

3. Knauf Insulation: www.knaufusa.com.
 4. Owens Corning Corporation: www.ocbuildingspec.com/sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
 2. Maximum Service Temperature: 850 degrees F.
 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
1. Aeroflex USA, Inc: www.aeroflexusa.com.
 2. Armacell LLC: www.armacell.us.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Maximum Service Temperature: 220 degrees F.
 2. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETING AND ACCESSORIES

- A. PVC Plastic Jacket:
1. Manufacturers:
 - a. Johns Manville Zeston 2000 Series White PVC or equal.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.
 3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
 2. Thickness: 0.025 inch sheet.
 3. Finish: Embossed.
 4. Fittings: 0.025 inch thick die shaped fitting covers with factory attached protective liner.
 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Hot Lines with Glass Fiber Insulation:
1. Pipe - Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips. Seal laps, pulling jacketing tight and smooth. Self sealing laps shall be secured according to manufacturers published recommendations. Open ends of pipe insulation shall be neatly stopped off and tapered down with insulating cement and covered with canvas embedded into a wet coat of fire retardant lagging adhesive.
 2. Fittings - All fittings shall be insulated with segments of glass fiber pipe insulation or loops of insulating blocks firmly held in place with #16 galvanized soft wire. Cover all fitting insulation with Zeston, or equal, white plastic fitting covers.
 3. Valves Etc. - All valve bodies, strainers and flanges shall be insulated as specified for fittings.
- C. Cold Lines with Glass Fiber Insulation:
1. Pipe - Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips. Seal laps, pulling jacketing tight and smooth. Ends of pipe insulation shall be sealed with a fire retardant vapor barrier coating at all fittings and valves, and at intervals of 21 feet on continuous runs of pipe. Self sealing laps shall be secured according to manufacturers published recommendations.
 2. Insulation, vapor barrier and covering shall be continuous through all domestic cold water pipe supports and pipe sleeves.
 3. Fittings - All fittings shall be insulated with molded fiber glass fittings, segments of pipe covering, or with compressed flexible glass fiber secured in place with non-corrosive wire. All thicknesses to be equal to that of adjoining pipe covering. Cover all fitting insulation with Zeston, or equal, white plastic fitting covers. If batt type insulation is used, it must be a minimum of 1 pound density and 1 inch thick.
 4. Valves Etc. - All valve bodies, strainers and flanges shall be insulated as specified for fittings.
- D. Cold Lines with Flexible Elastomeric Foam Insulation
1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inch on center.
 - d. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

- b. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
 - 4. Install preformed sections of cellular-glass insulation to valve body.
 - a. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - b. Install insulation to flanges as specified for flange insulation application.
- E. Roof Drain Sumps - Roof drain sumps shall be insulated as specified for fittings.
- F. Apply PVC jackets with longitudinal seams and end joints overlapping at least 2 inch. Seal weather tight with manufacturers recommended sealant. Apply the jacket such that the longitudinal seam is on the bottom of pipe.
- G. Exposed Piping: Locate insulation and cover seams in least visible locations.
- H. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, storage tanks, pump bodies, and expansion joints.
- I. Insulate sump pump discharge lines from sump pit to wall where discharge line leaves the building.
- J. Insulate all above grade cooling coil condensate discharge lines. This shall include, but not be limited to air handler, fan coil, furnace, and heat pump cooling coils.
- K. Insulate floor drain sumps and all horizontal sanitary waste pipe and fittings for all floor drains above grade receiving cooling coil condensate. Insulate horizontal sanitary waste line from floor drain to nearest vertical sanitary riser.
- L. Install insulation with factory-applied jackets with a manufacturer-approved adhesive along seams, both straight lap joints and circumferential lap joints.
 - 1. Inserts and Shields:
 - a. All domestic piping 1-1/2 inch and smaller, no insert is required below the insulation. Saddles shall be provided for all insulated piping. Both inserts and saddles shall be provided for all piping 2 inch and larger.
 - b. On domestic water, a pipe insulation protection saddle of 22 gauge galvanized sheet metal for piping 3 inch diameter and smaller, and 18 gauge for piping larger than 3 inch diameter, shall be provided at supports where pipe is supported by the insulation or inserts. The saddle shall be at minimum length of 12 inch.
 - c. Pipe supports for piping which operates below 250°F shall made be high density phenolic foam pipe insulation similar to Tru-Balance 2550FS saddles as manufactured by Buckaroos, Inc. Insulation in saddles shall meet ASTM E-84 ratings for 25/50 flame/smoke spread.
 - 2. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.
 - 3. Apply a PVC jacket to all exposed piping below 8' above finished floor in ALL rooms or spaces where occupants or staff can enter.
- M. Buried Piping: Provide 1/2 inch thick elastomeric thermal pipe insulation on pipe sizes up to 1-1/2 inch in diameter. Install per manufacturers recommendations. Provide PVC pipe conduit to encase insulated pipe.
- N. Equipment Insulation:
 - 1. Hot water storage tank system shall be insulated with 2 inch thick pre-molded mineral wool pipe insulation, 8 lb. density. All seams shall be taped smooth. Ends shall be finished with mastic, troweled smooth.
 - 2. Hot water storage tank system shall be insulated with two (2) layers as follows. One layer of 2 inch thick board and a second layer of 2 inch thick mineral wool, 8 lb density, pipe and

tank covering. Layers shall be applied with joints staggered. All seams shall be taped smooth. Ends shall be finished with mastic, troweled smooth.

3. Cold water storage tank and pneumatic system tank shall be insulated with 3/4 inch thick Armacell AP Armaflex foam sheet insulation. Insulation edges shall be cut straight and all joints adhered using an approved adhesive. Insulation shall be cut and formed to fit the contour of the tank with no void left between tank body and insulation. Installation of insulation shall be a neat workmanlike manner.
4. Water meter shall be insulated with 3/4 inch thick Armaflex II foam sheet insulation. Insulation edges shall be cut straight and all joints adhered using an approved adhesive. Insulation shall be cut and formed to match the contour of the water meter. Insulation shall be installed to minimize any void between the insulation and water meter. Installation of insulation shall be a neat workmanlike manner.
5. Insulation shall not be applied over equipment nameplates or ASME stamps. Bevel and seal insulation around such locations.

3.03 SCHEDULES

- A. Plumbing system glass fiber insulation sizes:

<u>Service</u>	<u>Pipe Size</u>	<u>Insulation Thickness</u>
Cold water	1-1/4 inch and less	1/2 inch
Cold water	1-1/2 inch and greater	1 inch
Rainleaders	All sizes	1 inch
Hot water (105F to 140F)	1 inch and less	1 inch
Hot water (105F to 140F)	1-1/4 inch to 1-1/2 inch	1-1/2 inch
Hot water (105F to 140F)	2 inch and greater	2 inch
Hot water (141F to 200F)	1-1/4 inch and less	1-1/2 inch
Hot water (141F to 200F)	1-1/2 inch and greater	2 inch

- B. For piping smaller than 1-1/2 inch and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted, but not to a thickness less than 1".
- C. Process or treated water systems shall be insulated as indicated below:
1. System below ambient temperatures shall be insulated as cold water piping according to table above.
 2. Systems above ambient temperatures shall be insulated as hot water piping according to table above.

END OF SECTION

SECTION 22 0784 - MECHANICAL FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all mechanical through and membrane penetrations in fire-resistance rated and smoke-resistant assemblies , whether indicated on drawings or not .

1.02 REFERENCE STANDARDS

- A. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2009.
- B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- C. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.
- D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.
- F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Schedule of Firestopping: List each type of penetration.
 - 2. Product Data: Provide data on product characteristics.
- C. Closeout Documents:
 - 1. Certificate from authority having jurisdiction indicating approval of materials used.

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 the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) 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. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors , or meeting any two of the following requirements:.
 - 2. With minimum 3 years documented experience installing work of this type.
 - 3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
 - 4. Licensed by authority having jurisdiction.

1.05 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
- B. Obtain approval of authority having jurisdiction before proceeding.
- C. If accepted, mock-up will represent minimum standard for the Work.
- D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.06 SCOPE / APPLICATION

- A. Provide installed firestop protects that limit the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in rated assemblies, including walls, partitions, floors, roof/ceilings, and similar locations. restoring the integrity of the fire rated construction to its original fire rating.
- B. Provide firestop systems listed for the specific combination of fire rated construction, type of penetrating item, annular space requirements, and fire rating, and the following criteria:
 - 1. F-Rating: Equal to or greater than the fire-resistance rating of the assembly in which the firestopping will be installed.
 - 2. T-Rating: In habitable areas where penetrating items are exposed to potential contact with materials on fire side(s) of rated assembly, T-rating must equal its F-rating.
 - 3. L-Rating: L-rating of 1 cfm per linear foot (5.5 cu m/h/m) maximum at ambient temperatures.
 - 4. Wall Penetrations: Systems must be symmetrical, with the same rating from both sides of the wall.

1.07 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. A/D Fire Protection Systems Inc: www.adfire.com.
- B. 3M Fire Protection Products: www.3m.com/firestop.
- C. Hilti, Inc: www.us.hilti.com.
- D. Nelson FireStop Products: www.nelsonfirestop.com.
- E. Specified Technologies, Inc: www.stifirestop.com.
- F. Pecora Corporation: www.pecora.com.
- G. Thermafiber, Inc: www.thermafiber.com.
- H. RectorSeal: www.rectorseal.com.
- I. International Protective Coatings Corp.

2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.
 - 2. Fire Ratings: See Drawings for required systems and ratings.

2.03 MATERIALS

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Cast-in-Place Devices: Firestopping device for use prior to a concrete pour. Adjustable height with pull tabs, straight edge design for close placement to walls and adjacent devices.
 - 1. Fire Resistance: For use in 1, 2, or 3 hour fire rated systems.
- C. One piece metal collar assembly encasing intumescent material for firestopping of pipes and cables through rated walls and floors.
 - 1. Fire Resistance: For use in 1 or 2 hour fire rated systems.

- D. Plastic Pipe Device: Intumescent device for firestopping of plastic pipe and cables through rated walls and floors.
 - 1. Configuration: One-piece metal collar, with locking latch and bendable tabs to secure; equipped also for conventional anchoring.
 - 2. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- E. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant;
 - 1. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- F. Foam Firestopping: Single component silicone foam compound;
- G. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers;
- H. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening;
- I. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, intended to be installed after penetrating item has been installed;
- J. Firestop Devices - Cast-In Type: Sleeve and sealing material, intended to be cast in concrete floor forms or in concrete on metal deck, not requiring any additional materials to achieve penetration seal.
 - 1. Durability and Longevity: Permanent.
- K. Intumescent Putty: Compound that expands on exposure to surface heat gain.
 - 1. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- L. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration;;
- M. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- C. Remove incompatible materials that could adversely affect bond.
- D. Install backing materials to arrest liquid material leakage.
- E. Verify that items penetrating fire rated assemblies are securely attached, including sleeves, supports, hangers, and clips.
- F. Verify that openings and adjacent areas are not obstructed by construction that would interfere with installation of firestopping, including ducts, piping, equipment, and other suspended construction.
- G. Install masking and temporary coverings as required to prevent contamination or defacement of adjacent surfaces due to firestopping installation.

3.03 INSTALLATION

- A. Non-rated assemblies shall be draft stopped.
- B. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

- C. Install so that openings are completely filled and material is securely adhered.
- D. Where firestopping surface will be exposed to view, finish to a smooth, uniform surface flush with adjacent surfaces.
- E. After installation is complete, remove combustible forming materials and accessories that are not part of the listed system.
- F. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned.
- G. Do not cover firestopping with other construction until approval of authority having jurisdiction has been received.
- H. Do not cover installed firestopping until inspected by authority having jurisdiction.
- I. Install labelling required by code.
- J. Install identification Labels for Through Penetration and Construction Joint Systems: Pressure sensitive self-adhesive vinyl labels, preprinted with the following information:
 - 1. The words "Warning - Through Penetration Firestop System - Do not Disturb. Notify Building Management of Any Damage."
 - 2. Listing agency's system number or designation.
 - 3. System manufacturer's name, address, and phone number.
 - 4. Installer's name, address, and phone number.
 - 5. General contractor's name, address, and phone number (if applicable).
 - 6. Date of installation.

3.04 CLEANING

- A. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned
- B. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

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

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, above grade.
- D. Storm drainage piping, buried within 5 feet of building.
- E. Storm drainage piping, above grade.
- F. Pipe flanges, unions, and couplings.
- G. Pipe hangers and supports.
- H. Pipe sleeve-seal systems.
- I. Pressure reducing valves.
- J. Pressure relief valves.

1.02 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.
- E. ASME B31.9 - Building Services Piping; 2020.
- F. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- G. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.
- H. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- J. ASTM B32 - Standard Specification for Solder Metal; 2020.
- K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2025.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
- N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- P. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2026.
- Q. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
- R. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

- S. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).
- T. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.
- U. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).
- V. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).
- W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- X. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- Y. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).
- Z. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.
- AA. AWWA C606 - Grooved and Shouldered Joints; 2015.
- BB. AWWA C651 - Disinfecting Water Mains; 2023.
- CC. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.
- DD. 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; 2020.
- EE. FM 1680 - Examination Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 2025.
- FF. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- GG. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- HH. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- II. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- JJ. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- KK. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - 2. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Closeout Documents:
 - 1. Project Record Documents

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe (epoxy coated): CISPI 301, hubless.
 - 1. Fittings: Cast iron (epoxy coated).
 - 2. Joints: CISPI 310, neoprene gasket and heavy duty stainless steel clamp and shield assemblies.
 - 3. Provide on-site coating of cut edges equal to PPG Multi-Prime 4160 or Fast Dry 4180 coating following all manufacturer instructions.
- B. PVC Pipe: ASTM D2665
 - 1. Fittings: PVC
 - 2. Joints: Solvent welded, ASTM D2665 with solvent cement

2.03 SANITARY WASTE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, ASTM A888 hubless,.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C1540 neoprene gaskets heavy-duty stainless steel clamp-and-shield assemblies. For vent piping, provide neoprene gaskets with standard duty stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: ASTM D2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5- FEET OF BUILDING

- A. Copper Pipe: ASTM B42, type K, annealed.
 - 1. No fittings below grade.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: Ductile or gray iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88, (ASTM B88M), 1 1/2 inch and smaller shall be Type L hard drawn copper. Tubing 2 inch and larger shall be Type M hard drawn copper. Soft drawn copper tubing in small sizes may be used adjacent to fixtures and equipment.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Apollo Valves: www.apollovalves.com/#sle.
 - 2) Viega LLC: www.viega.com.
 - 3) Nibco
 - 4) Milwaukee
 - 5) Substitutions: See Section 01 6000 - Product Requirements.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron.
 2. Joints: Neoprene gaskets and heavy-duty stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: ASTM D2665.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron.
 2. Joints: Neoprene gaskets and heavy-duty stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: ASTM D2665.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.08 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch and Under:
 1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Sizes Over 1 inch:
 1. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 1. Dimensions and Testing: In accordance with AWWA C606.
 2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
 3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
 4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 6. Manufacturers:
 - a. Victaulic - Style 606.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. No-Hub Couplings (Sanitary Vent Piping Only):
 1. Testing: In accordance with ASTM C1277 and CISPI 310.
 2. Gasket Material: Neoprene complying with ASTM C564.
 3. Clamp: Type 304 Stainless Steel.
 4. Band Material: Type 304 Corrugated Stainless steel (0.010-inch thick).
 5. Screw Material: Type 305 or 304L Stainless steel (5/16").
 6. Manufacturers:
 - a. Husky SD-2000.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

- E. Shielded, Heavy Duty No-Hub Couplings:
 - 1. Testing: In accordance with ASTM C1540 and FM 1680.
 - 2. Gasket Material: Neoprene complying with ASTM C564.
 - 3. Clamp: Type 304 Stainless Steel.
 - 4. Band Material: Type 304 Corrugated Stainless steel (0.015-inch thick).
 - 5. Screw Material: Type 305 or 304L Stainless steel (3/8").
 - 6. Manufacturers:
 - a. Husky SD-4000.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- F. Shielded, Heavy Duty, Corrosion Resistant No-Hub Couplings (for use with epoxy coated cast iron piping):
 - 1. Testing: In accordance with ASTM C1540.
 - 2. Gasket Material: Neoprene complying with ASTM C564.
 - 3. Clamp: Type 316 Stainless Steel.
 - 4. Band Material: Type 316 Corrugated Stainless steel (0.015-inch thick).
 - 5. Screw Material: Type 316 Stainless steel (3/8").
 - 6. Manufacturers:
 - a. Husky CR-7000.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- G. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.09 PIPE HANGERS AND SUPPORTS

- 1. Manufacturers:
 - a. Anvil
 - b. Erico-Caddy
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Hangers and strut located in corrosive areas shall be type 316 stainless steel with stainless steel hardware.
- 3. Hangers for all piping shall be oversized to encircle the piping and the insulation, the insulation shall be continuous through all hangers.
 - 1) Cold and Hot Pipe Sizes 6 inch and Larger: Double hangers.
- b. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
- 4. Roof pipe supports:
 - a. Compact pipe support: Piping shall be supported by a polyethylene, or vulcanized recycled rubber block with an integral strut channel for receiving standard clamps and/or support accessories. Water piping, natural gas piping, etc. shall be placed at the same elevation where running parallel. Pipe supports shall be installed according to manufacturer's recommendations. Pipe supports shall be spaced as indicated in following section. Supports shall be installed to allow for expansion and contraction and shall not be adhered to roof surface.
 - b. Pipe stands: Piping shall be supported from stands supported from the roof by vulcanized recycled rubber blocks with an integral strut channel. Pipe stands supported by the roof blocks shall be constructed of a minimum 12 ga. Channel with connectors consisting of 1/2" bolts, 1/2" washers & 1/2" nuts. Hangers suspended from pipe stands shall be as specified in the previous section. Supports shall be installed to allow for expansion and contraction and shall not adhere to the roof surface.
 - c. All hanger hardware located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123/A123M. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor use.
 - d. Manufacturers:
 - 1) Erico

- 2) Advanced Support Products
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Hanger Rods: Zinc-plated steel, threaded both ends, threaded one end, or continuous threaded.
 4. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
 5. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
 6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 6 inch and Larger: Adjustable steel yoke, cast iron pipe roll, double hanger.
 5. Hanger Rods: Zinc-plated steel, threaded both ends, threaded one end, or continuous threaded.
 6. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
 7. Wall Support for Pipe Sizes 4 inch and Larger: Welded steel bracket and wrought steel clamp.
 8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
 10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated for uninsulated copper pipe.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
 2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.

2.10 PIPE SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
1. Link-Seal an EnPro Industries Company: www.linkseal.com
 2. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Modular Mechanical Seals:
1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
 2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
 3. Size and select seal component materials in accordance to service requirements.
 4. Glass reinforced plastic pressure end plates.

2.11 PRESSURE REDUCING VALVES

- A. Manufacturers:
1. Watts Regulator Company: www.wattsregulator.com.
 2. Zurn Industries, LLC: www.zurn.com/#sle.

- 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. 2 inch and Smaller:
 - 1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
 - 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, pressure gauges, and isolation valves.
- C. 2 inch and Larger:
 - 1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
 - 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.12 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.13 STRAINERS

- A. Manufacturers:
 - 1. Titan Flow Control, Inc.: www.titan.com
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Size 2 inch and Smaller:
 - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 - 2. Class 125, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Size 1-1/2 inch to 4 inch:
 - 1. Class 125, flanged ductile iron body (epoxy coated), Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Remove scale and dirt, on inside and outside, before assembly.
- B. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. The contractor shall note plastic pipe is not allowed above the ceilings in any areas that are used as return air plenums.
- C. Plastic DWV piping shall be installed as addressed by IAPMO (UPC) section on Expansion and Contraction. Any straight runs of plastic DWV piping exceeding 30 feet shall be installed to accommodate thermal expansion.
- D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

- F. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- G. Group piping whenever practical at common elevations.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 1. See Section 22 0719.
- J. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 08 3100.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- L. Paint exterior steel piping with two coats of Rust-Oleum of color matching architectural metal or utility served.
- M. Provide support for utility meters in accordance with requirements of utility companies.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
 - 1. All exposed gas piping outdoors shall be cleaned of all dirt, grease and oil, painted with one coat primer and two coats enamel of a color to be selected by the architect. If steel piping is used, a second option shall be galvanized in lieu of painting.
- O. Excavation, Trenching, and Backfilling
 - 1. Excavation and Trenching: The bottom of trenches shall be tamped hard and graded to secure required fall. Bell holes shall be excavated so that pipe shall rest on solid ground for its entire length. Rock, where encountered, shall be excavated to a depth of six (6) inches below the bottom of the pipe, and before pipe is laid, the space between the bottom of the pipe and the rock surface shall be filled with gravel. All surplus excavating materials shall be removed from the job site to location directed by the Architect.
 - 2. Filling and Backfilling - Interior: At areas below concrete floor slab on ground, a sandy loam backfill shall be placed in 6" layers and thoroughly compacted by approved means at optimum moisture to a density of 95% or Standard Proctor Density. Sandy loam fill shall contain not more than 10% of clay and/or silt. Fill shall not contain gravel particles larger than 1/2". Material for backfill shall be approved by Architect and by an approved testing laboratory.
 - 3. Tests shall be made at expense of the Contractor by an approved testing laboratory, to determine adequacy of compaction. These tests shall be made during the compaction operation at various levels to insure uniformity of compaction and test reports shall show elevation as well as location of tests. The testing laboratory inspector shall be on the site at intervals during all major backfilling operations. Compaction tests shall be made at locations as directed by Architect.
 - 4. Cracked and/or damaged floor slabs, walls or partitions resulting from improper compaction of fill materials shall be repaired or replaced, as directed by Architect, at the Contractor's expense.
- P. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.
- Q. Install water piping to ASME B31.9.
- R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- T. Polypropylene Piping:
 - 1. All installation of polypropylene piping shall be conducted by a factory trained installer.

2. The contractor shall coordinate and solicit a factory representative to conduct two (2) site inspections during the installation phase of construction. The contractor shall remediate any issues discovered during the inspection at no additional cost to the owner.
- U. Sleeve pipes passing through partitions, walls, and floors.
- V. Inserts:
1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- W. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
 2. Support horizontal piping as per local plumbing codes.
 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 4. Place hangers within 12 inches of each horizontal elbow.
 5. Hangers shall not be placed on couplings.
 6. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 7. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 9. Provide copper plated hangers and supports for copper piping.
 10. Provide stainless steel hangers and rods for piping installed in corrosive environments (ie. swimming pools, green houses, etc.).
 11. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - a. Painting of interior plumbing systems and components is specified in Section 09 9123.
 - b. Painting of exterior plumbing systems and components is specified in Section 09 9113.
 12. Provide hangers adjacent to motor-driven equipment with vibration isolation; see Section 22 0548.
 13. Support cast iron drainage piping at every joint within 18 inches.
 14. All hangers shall be oversized to encircle the piping and the insulation. Insulation shall be continuous through all hangers.
- X. Pipe Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a watertight seal.
 6. Install in accordance with manufacturer's recommendations.

- Y. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Provide spring-loaded check valves on discharge of water pumps.
- D. Provide flow controls in water recirculating systems where indicated.
- E. Piping installed in ventilation plenums
 - 1. In all cases, product and piping assembly shall meet flame and smoke spread ratings of 25/50
 - 2. Cast Iron
- F. High Temperature Water (130 degrees F and higher)
 - 1. Waste from commercial kitchens, boiler blowdown, steam humidifiers, etc. shall be cast iron or CPVC similar to SPEARS lab waste and fittings as herein specified. These drain lines may be connected to PVC waste lines where a continuous flow of cold water is present to blend with the hot waste or as indicated on drawings.
- G. Gas Piping:
 - 1. Steel gas piping greater than 2 inch shall be welded.
 - 2. Gas piping installed in plenums.
 - a. Steel gas piping in plenums shall be welded.
 - b. In lieu of steel, If copper is allowed by AHJ, brazed joints are allowed.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 33 0110.58.
- B. Prior to starting work, verify system is complete, flushed, and clean.
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of 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.

3.07 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved water meter with by-pass valves. Meter size based on _____ gpm and _____ psi pressure drop.

1. Provide schd. 40 steel sleeve in wall for service main and support at wall. Provide LINK-SEAL in sleeve at wall penetration. Anchor service line inside to concrete wall.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Washing machine outlet boxes.
- D. Ice maker outlet boxes.

1.02 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor Drains; 2022.
- B. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- C. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
 - 2. SIndicate dimensions, weights, and placement of openings and holes.
 - 3. Certificates: Certify that grease interceptors meet or exceed specified requirements.
- C. Closeout Documents:
 - 1. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- D. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. MIFAB, Inc: www.mifab.com/#sle.
 - 4. Zurn Industries, LLC: www.zurn.com.
 - 5. Watts
 - 6. Wade
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Floor Drain FD:
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, square adjustable nickel-bronze

strainer and separate deep seal trap. For floor drains in mechanical rooms, provide a round drain with recessed strainer.

2.03 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. MIFAB, Inc: www.mifab.com/#sle.
 - 4. Zurn Industries, LLC: www.zurn.com.
 - 5. Wade.
 - 6. Watts
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Cleanouts at Exterior Surfaced Areas:
 - 1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas:
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas:
 - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
- E. Cleanouts at Interior Finished Wall Areas:
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- F. Cleanouts at Interior Unfinished Accessible Areas:
 - 1. Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
- G. Inter al plugs shall be constructed of brass, PVC or ABS.

2.04 WASHING MACHINE TRIM BOXES AND VALVES (WMT-1)

- A. Box Manufacturers:
 - 1. IPS Corporation/Guy Gray FRM12SHA Powder Coated Steel: www.ipscorp.com.
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Valve Manufacturers:
 - 1. IPS Corporation[<>]: www.ipscorp.com.
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Description: Metal preformed rough-in box with brass valves with quarter-turn handle, socket for 2 inch waste, slip in finishing cover. Integral water hammer arrestor.

2.05 REFRIGERATOR AND ICE MACHINE TRIM BOXES AND VALVES (IMT-1)

- A. Box Manufacturers:
 - 1. IPS Corporation/Guy Gray FRIB12ABSHA High Temperature Resin : www.ipscorp.com
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Valve Manufacturers:
 - 1. IPS Corporation[<>]: www.ipscorp.com.
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Description: High Temperature Resin preformed rough-in box with quarter turn brass valve, slip in finishing cover. Integral water hammer arrestor .

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Where required by code, a cleanout shall be installed above the fixture connection fitting, serving each urinal, regardless of the location of the urinal in the building. Coordinate exact location of each cleanout with the Architect.
- F. Each floor-set floor drain (e.g., floor drains, shower drains, floor sinks, mop basins) with traps that are not accessible shall be provided with full size cleanouts.
- G. Building sewers shall have cleanouts not more than 75' apart for 4" pipe and not more than 100' apart for larger pipe.
- H. Provide a cleanout at the connection point of new and existing systems to allow for the testing of all new piping systems. Additional building cleanouts shall be installed at each horizontal change in direction exceeding 135-degrees.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall hung urinals.
- B. Lavatories.
- C. Wall-hung, multistation wash fountains.
- D. Sinks.
- E. Bathtubs and showers.
- F. Bi-level, electric water coolers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).
- C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- D. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
- E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
- F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
- G. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.
- H. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- J. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- K. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Closeout Documents:
 - 1. Manufacturer's Instructions: Indicate installation methods and procedures.
 - 2. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
 - 3. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 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.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. This Contractor shall submit a portfolio showing fixtures and trimmings to the Architect for his approval.

2.02 FIXTURE SUPPORT AND FASTENINGS

- A. All fixtures shall be securely anchored independent of finished wall.
- B. Fastening to masonry walls shall be by brass bolts or machine screws in lead sleeve type anchorage units, or 1/4 inch brass expansion bolts of sufficient length to extend at least 3 inches into solid masonry.
- C. Fastening to wood partitions shall be by the use of round head brass wood screws. Wood screws shall go into solid wood, such as wood inserts, floor joists, studs, or 2" x 6" set between studs.
- D. Fixture fastening with steel stud partitions shall be done by bolting or welding a 3/8" x 6" wide steel plate to studs and extending the plate one stud beyond the first and last fixture mounting points or provide an equivalent rigid mounting frame in wall. Fixture carriers shall be provided where noted.
- E. All water supply pipe stubs through walls to shower heads and to flush valves shall be securely anchored within the wall or plumbing space.

2.03 ACCESSORIES

- A. Carriers:
 - 1. See Fixtures
- B. Stops
 - 1. Manufacturers:
 - a. Brass Craft
 - b. McGuire
 - c. Substitutions: See Section 01 60 00-Product Requirements.
 - 2. Faucet, stop valves, traps, etc., shall be heavy cast brass. Water lines to all individual fixtures shall be equipped with high grade chromium plated brass compression stop valves. Each individual fixture shall be provided with valves on the supply line.
 - a. Stop valves: Brass Craft KTCR19X C, 1/4 turn ball valve, chrome plated, with Tee handle.
 - b. Stop valves with dual outlets for coffee makers, dishwashers, etc., shall be Brass Craft CR1901LR1, Multi turn compression valves, or prior approved equal.
- C. Undercounter Dishwashers shall be connected via approved air gap fitting.

2.04 MANUFACTURERS

- A. China Fixtures
 - 1. American Standard, Kohler, Sloan, Zurn Commercial or approved equal.
- B. Fixture Carriers
 - 1. Josam, Wade, Smith, Zurn, Watts or approved equal.

- C. Flush Valves:
 - 1. Sloan, Zurn, Toto, Hydrotek (8200 Model Only) or approved equal.
- D. Lavatory Trim:
 - 1. American Standard, Kohler, T & S Brass, Chicago Faucet, Moen Commercial, Zurn Commercial, Delta, Acorn, Hydrotek, or approved equal.
- E. Sink Trim:
 - 1. American Standard, Kohler, T & S Brass, Chicago Faucet, Moen Commercial, Zurn Commercial, Delta, Acorn or approved equal.
- F. Seats:
 - 1. Bemis, Olsonite, Beneke, Church, Toto or approved equal.
- G. Sinks:
 - 1. Elkay, Just, or approved equal.
- H. Electric Water Coolers:
 - 1. Halsey Taylor, Elkay, Haws, Acorn, Oasis, Murdock or approved equal.
- I. MB and Laundry Tubs:
 - 1. Fiat, Swan, Zurn Jonespec, Mustee, Acorn, or approved equal.
- J. Thermostatic Mixing Valves:
 - 1. Leonard, Lawler, Caleffi, Watts Regulator, Powers, or approved equal.
- K. Trap Wraps:
 - 1. Brocar, Truebro, Plumberex, Lav-Guard, Proflo or an approved equal.

2.05 FIXTURES

- A. NSF International certified sinks shall be used in all food prep areas.
- B. L-1, Lavatory:
 - 1. Lavatory: Kohler Greenwich K-2032, Wall hung, Vitreous china, with back, anti-splash rim, arm support carrier.
 - 2. Trim: Chicago Faucets 116.606.AB.1, battery operated faucet with infrared sensor, 0.5 GPM vandal proof, perforated strainer, single-hole deck mount, 1-1/4" brass tailpiece, ADA compliant.
 - 3. Thermostatic Mixing Valve: Lawler TMM-1070-LPM, Lead Free, ASSE 1070 Certified, bronze body point of use mixing valve with 3/8" inlet and outlet compression connections, inlet check valves with stainless steel screen, and mounting bracket.
 - 4. Supplies: 3/8" angle supplies flexible tube riser, brass stops, chromed finish.
 - 5. Trap: 1-1/4" adjustable cast brass "P" trap.
 - 6. Size: 20 1/2" x 18 1/4"
 - 7. Arm Support Carrier: Smith #0700 or equal.
 - 8. Trap Guard: Truebro Lav Guard 2, P-trap and wall supplies insulation kit.
 - 9. Mounting: Refer to Architectural wall section for mounting height.
- C. L-2, Lavatory:
 - 1. Lavatory: Sink bowl to be provided by Architect.
 - 2. Trim: Chicago 420-T, centerset lavatory faucet with integral spout, ceramic disk cartridge, single lever control with aerator, pop-up waste assembly, 1-1/4" brass tailpiece, ASSE 1070 compliant internal mixing valve. Chicago Faucets 116.606.AB.1, battery operated faucet with infrared sensor, 0.5 GPM vandal proof, perforated strainer, single-hole deck mount, 1-1/4" brass tailpiece, ADA compliant.
 - 3. Thermostatic Mixing Valve: Lawler TMM-1070-LPM, Lead Free, ASSE 1070 Certified, bronze body point of use mixing valve with 3/8" inlet and outlet compression connections, inlet check valves with stainless steel screen, and mounting bracket.
 - 4. Supplies: 3/8" angle supplies with flexible tube risers, brass stops, chromed finish.

5. Trap: 1-1/4" adjustable cast brass "P" trap.
 6. Trap Guard: Trap Guard: Truebro Lav Guard 2, P-trap and wall supplies insulation kit.
- D. L-3, Lavatory
1. Lavatory: Sink bowl to be provided by Architect.
 2. Trim: Chicago Faucet #2200-4E70ABCP, centerset lavatory faucet with integral spout, 0.5 gpm, ceramic disk cartridge, single lever control with aerator, perforated strainer, 1-1/4" brass tailpiece.
 3. Thermostatic Mixing Valve: Lawler TMM-1070-LPM, Lead Free, ASSE 1070 Certified, bronze body point of use mixing valve with 3/8" inlet and outlet compression connections, inlet check valves with stainless steel screen, and mounting bracket.
 4. Supplies: 3/8" angle supplies with flexible tube risers, brass stops, chromed finish.
 5. Trap: 1-1/4" adjustable cast brass "P" trap.
 6. Trap Guard: Truebro Lav Guard 2, P-trap and wall supplies insulation kit.
- E. WC-1, Water Closet:
1. Closet: Kohler Kingston K-84325, Wall hung, Flush valve, vitreous china, siphon jet, elongated bowl, fully glazed trapway, 1-1/2" top spud, bolt caps, 1.6 or 1.28 gallon flush.
 2. Flush Valve: Sloan Royal 111 SMO-1.6, battery operated sensor flush valve, 1.6 gallons per flush..
 3. Seat: Bemis 1955SSCT white solid plastic, check hinge, self-sustaining, stainless steel hinge posts, open front, less cover.
 4. Carrier: Josam, Wade, Zurn, or Smith. Note: For applications with wide chase or where the wall thickness exceeds 8" provide manufacturer's bolt and nipple support.
 5. For Bariatric water closets, provide heavy duty carrier rated for 500 lbs load. Heavier load carriers available, check fixture rating.
 6. Mounting: Refer to Architectural wall section for mounting height.
- F. U-1, Urinal:
1. Urinal: Kohler Bardon K-4991-ET, Wall hung, flush valve, vitreous china, siphon jet, 3/4" top spud, integral flushing rim, universal carrier.
 2. Flush Valve: Sloan Royal 186-0.5 manual 0.5 gallon flush.
 3. Carrier: Josam, Wade, Zurn, Watts or Smith.
 4. Mounting: Refer to Architectural wall section for mounting height.
- G. B-1, Bathtub:
1. One piece gel-coat fiberglass tub/shower module with slip resistant bottom. ADA Compliant. Tub surround, seat area, and grab bars shall be provided by Architect.
 2. Tub/Shower: Kohler, Model #Avec K-25831
 3. Trim: Moen Commercial T8341 trim kit with 8371HD valve body, single lever control, pressure balancing anti-scald valve with 1/4 turn stops, tub diverter spout and shower system kit including hand shower w/ 59" hose and wall support, in-line vacuum breaker, and 25" slide bar. Hand shower system shall have all metal parts, no plastic.
 4. Waste: Dearborn #228-3 brass tubular toe touch bath drain.
 5. Installation: Grout base of tub/shower units. Refer to manufacturer's requirements regarding grouting of base for warranty purposes.
 6. Mounting: Refer to Architectural elevation.
- H. S-1, Sink:
1. Sink: Elkay LRAD2521, Countertop, single compartment, type 304, 18-8 stainless steel, 18 gauge, self-rimming, back ledge.
 2. Trim: Chicago 786-GN8AE3ABCP with 8" gooseneck spout, wristblade handles, aerator, LK-35 stainless steel basket strainer.
 3. Trap: Chrome plated cast brass "P" trap.
 4. Supplies: 3/8" angle supplies with flexible tube riser, brass stops, chromed finish.
 5. Size: 16" x 13-1/2" x 7-5/8"

6. Trap Guard: Truebro Lav Guard Model 102 E-Z, P-trap and wall supplies insulation kit.
- I. S-2, Sink:
 1. Sink: Elkay LR3319, Countertop, double compartment, type 304, 18-8 stainless steel, 18 gauge, self-rimming, back ledge.
 2. Trim: Chicago 786-GN8AE3ABCP with 8" gooseneck spout, wristblade handles, aerator, LK-35 stainless steel basket strainer.
 3. Trap: Chrome plated cast brass "P" trap.
 4. Supplies: 3/8" angle supplies with flexible tube riser, brass stops, chromed finish.
 5. Size: 33" x 19-1/2" with two (2) 14" x 14" x 7-5/8" bowls
 6. Trap Guard: Truebro Lav Guard Model 102 E-Z, P-trap and wall supplies insulation kit.
- J. EWC-1, Electric Water Cooler with Bottle Filler
 1. Elkay # EZSTL8WSLK, dual height, wall hung water cooler and bottle filling station, touch controls front and side, stainless steel top and cabinet. Bottle filler shall be sensor activated.
 2. Cooler shall have the capacity to cool 8 GPH to 50°F with inlet water at 80°F and 90°F room temperature. Compressor shall be 1/6 HP, 120 volt. Tank shall be lead-free. Provide Flexi-Guard, stainless steel Safety Bubbler.
- K. MB-1, Mop Basin:
 1. Basin: Fiat Model MSB2424 molded stone, 3" stainless steel drain body with dome strainer.
 2. Trim: Chicago Faucet #897-CP ceramic disk cartridge, service sink faucet with vacuum breaker, 3/4" hose thread spout, adjustable wall brace, pail hook. Furnish 3/4" garden hose.
 3. Provide horizontal swing, Y-pattern check valves similar to Nibco #T/S-413 to be installed in hot and cold supply lines.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with handle stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall carriers and bolts.
- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.
- F. Where fixtures come in contact with floor or wall, joint shall be sealed with silicone caulking of color to match fixture.
- G. Provide stainless steel wall escutcheon on waste pipe through the wall for lavatories and sinks.
- H. For all flush valves installed in ADA installations, coordinate space for service of flush valve with grab bars.

- I. For connection to residential dishwasher, provide stainless steel braided hose from stop valve to dishwasher connection.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Kitchen Equipment:
 - 1. Equipment furnished by the Kitchen Equipment Supplier/Contractor shall have rough-ins and accessories, provided by this contractor. Final mounting and connections including indirect connections shall also be provided by this contractor.
 - 2. Coordinate with them for a complete system including shut-offs, risers, tail piece, traps, etc.
 - 3. Connections may included but not be limited to cold water, hot water, waste, vent, and gas.
 - 4. Kitchen equipment hand sinks shall be provided with ASSE 1070 thermostatic mixing valve by this contractor unless otherwise coordinated with the Kitchen Equipment Supplier/Contractor.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. Adjust wristblade handles on all sinks and lavatories to be rotated 22.5-degree forward.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0060 - MECHANICAL DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Contract documents and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections apply to this section.
- B. This section specifies the demolition and removal of all HVAC equipment and distribution conduits including but not limited to ductwork, piping, controls, insulation, and accessories in existing building.
- C. Unless otherwise noted in the Documents, all salvage items removed in connection with this Contract are to become the property of the Contractor, however the Owner shall have the first right of refusal on all equipment removed.

1.02 SUBMITTALS

- A. Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- B. Schedule of selective demolition activities:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of building utility services.
 - 3. Coordination for shutoff, capping and continuation of services.
 - 4. Coordination of Owner's continued occupancy of portions of existing building and of Owner's occupancy of completed work.
- C. Pre-demolition photographs or videotape showing existing pre-demolition conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before demolition work begins.

1.03 PROJECT CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct demolition so Owner's operation will not be disturbed. Provide not less than 48-hour notice to Owner of activities that will affect the Owner's operations.
- B. Maintain existing services to Owner occupied areas during demolition if possible or coordinate interruption of services prior to demolition.
- C. Owner assumes no responsibility for condition of area to be selectively demolished.
- D. Hazardous Materials:
 - 1. It is not expected that hazardous materials will be encountered in the Work.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and existing ductwork and piping arrangements are as shown on Drawings.
- B. Verify that abandoned equipment serves only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents. The demolition Drawings are diagrammatic and show the general scope of demolition work and do

not show all the construction detail of the original record drawings. Report discrepancies to the Project Engineer before disturbing existing installation.

- D. The Contractor shall visit the existing building and grounds and review the existing building record drawings for details of existing installation to familiarize themselves with existing conditions prior to submitting bid. No allowance will be made subsequently, in this connection, on behalf of the Contractor for any error or negligence on his part.
- E. Beginning of demolition means the Contractor accepts existing conditions.

3.02 PREPARATION

- A. Disconnect mechanical systems in areas scheduled for removal. Notify Project Engineer and Owner of areas to be affected by mechanical demolition work prior to commencing.

3.03 SELECTIVE DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and remove from site and extend existing mechanical work under provisions of this Division and as indicated on the Drawings unless otherwise noted.
- B. Salvage items noted to remain the property of the Owner shall be delivered to a location to be designated by the Owner. Contractor shall remove from construction areas all trash or debris as it accumulates and dispose of it off site at no additional cost to the Owner. All construction areas shall be kept clean, safe, and orderly at all times. At the completion and acceptance for work, Contractor shall remove from the site all debris and surplus materials resulting from this work and dispose of them off site at no additional cost to the Owner.
- C. Do not use cutting torches until work area is clear of flammable materials. At concealed spaces verify condition and contents of hidden space before starting flame cutting operations. Maintain Fire Watch and portable fire-suppression devices during flame-cutting operations. Maintain and evaluate ventilation during flame-cutting operations.
- D. Maintain ventilation for dust control during selective demolition process. Verify Owner requirements for dust control and conform to their standards for all demolition activities.
- E. Remove, relocate, and extend existing installations to accommodate new construction as required for proper installation and system operation.
- F. Remove all accessories above grade. When removing equipment or terminal devices all associated pipe, duct, ATC devices, wiring, etc. shall be removed and capped as required. Cut piping, duct, tubing, etc. behind walls, above ceilings and below floors, and patch surfaces to match existing conditions. Finishes will be by others unless otherwise noted in documents.
- G. Neatly cut openings and holes plumb, square and true to dimension required. Use cutting methods least likely to damage construction to remain or adjoining construction. Cut and drill from exposed surfaces into concealed surfaces to avoid marring or spalling of finished surfaces. Temporarily cover openings to remain.
- H. Patch all openings created by removal of mechanical equipment, ATC devices, ducts, pipes, etc. unless noted as being patched by others. Openings to be patched to match existing with similar materials and finish unless otherwise noted.
- I. Seal all existing roof penetrations, which will not be reused. Roof patching shall be by project roofing contractor, or an Owner approved roofing contractor.
- J. Remove, relocate, or provide brackets, hangers, and other accessories as required.
- K. Repair adjacent construction and finishes damaged during demolition and extension work.
- L. Maintain access to existing mechanical installations, which remain active.

3.04 SALVAGE

- A. All items removed from existing building shall be salvaged in a workmanlike manner.
- B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and

equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

3.05 CLEAN AND REPAIR

- A. Clean and repair existing materials and equipment, which remain or are to be returned to the Owner.
- B. All building surfaces damaged and openings left by new Work or the removal or relocation of mechanical equipment, piping, etc., shall be repaired to original condition and painted by the Contractor.

END OF SECTION

SECTION 23 0100 - MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 APPLICABILITY

- A. This section applies to and forms a part of each of the sections of Division 23. This section, and each of the sections to which it applies, is subject to the requirements of the Instructions to Bidders, General Conditions, and Special Conditions of these complete specifications.
- B. The work covered by this Division of the Specifications consists of furnishing all labor, supervision, equipment, materials, all incidentals, related items, and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.
- C. All work shall be finished, tested and ready for operation.

1.02 DEFINITIONS

- A. Words "Material" or "Furnish" where written in Division 23 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.
- B. Words "Labor" or "Install" where written in Division 23 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.
- C. Word "Provide" where written in Division 23 specifications and drawings shall mean "Mechanical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".

1.03 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

- A. Notify the Engineer of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.
- B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.
- C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.
- D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished and installed.
- E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.
- F. Any work not clear to Contractor shall be referred to Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Engineer, whose decision is final, without additional charges.
- G. By virtue of submitting a bid, Contractor agrees that they are skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that they have carefully reviewed all drawings, all specifications, and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

1.04 DRAWINGS

- A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets,

fittings, connections, and accessories which may be required. Furnish offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.

- B. All piping and ductwork shall be routed so as not to obstruct access to other equipment (i.e. VAV box controls, electrical devices, fire alarm devices, etc.). Routing indicated on drawings is representative of intended location but shall be field verified. It shall be this contractor's responsibility to coordinate with other trades for accessibility.
- C. Any work or system on the roof not explicitly indicated on the roof plan shall be approved by the engineer prior to installing.
- D. In general, the mechanical equipment drawings are drawn to scale as noted. Obtain dimensions and locations of partitions, walls, etc., from the Architectural drawings wherever possible and do not scale the mechanical drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.
- E. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.05 SITE INSPECTION

- A. Before submitting a proposal for the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themselves with all the existing conditions and limitations, including the extent of demolition, cutting, and patching to be done by the Contractor for Mechanical Work. No extras will be allowed because of the Contractor's misunderstanding as to the amount of work involved, or his lack of knowledge of any condition in connection with the work.

1.06 PRIOR APPROVAL REQUESTS

- A. Where the Bid Documents stipulate a particular Product, substitutions will be considered by the Engineer up to 10 days before receipt of bids.
- B. The submission shall provide complete information, test, etc. relating to quality, performance, suitability, to determine acceptability of such products.
- C. When a request to substitute a Product is made, the Engineer may approve the substitution and will issue an Addendum to known bidders.
- D. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.
- E. The cost of any changes of other trades as a result of use of the substitution material or equipment must be borne by the Contractor submitting such material or equipment.

1.07 REVIEW OF MECHANICAL MATERIALS AND EQUIPMENT

- A. Within thirty (30) days after award of construction contracts, Contractor shall submit for acceptance to the Architect quantity of shop drawings specified for the equipment indicated in these specifications. The shop drawings shall include the equipment manufacturer's name and address, catalog designation or model number, rough-in data & dimensions, performance curves and rated capacities & operational characteristics.
- B. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to submittal. Each shop drawing set shall be stamped, signed, and dated indicating Contractor review and submitted electronically via PDF file format. The PDF file name shall include the relevant specification section number for reference. If the Contractor fails to properly review shop drawings, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.

- C. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.
- D. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.
- E. The Engineer will review all Shop Drawings submitted and will retain a copy for record file.
- F. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:
 - 1. "No Exception Noted" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation.
 - 2. "Make Corrections Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time.
 - 3. "Revised and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at their discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
 - 4. "Rejected" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.
- G. If the Engineer rejects (Revised and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews. Any subsequent submittal will require the inclusion of a check made out to the engineer in the amount of \$500.00. Contractor is responsible for all delays caused by the resubmittal process.
- H. Should the contractor fail to comply with any of the requirements of the preceding sub-paragraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.
- I. When the contractor chooses to furnish and reviewed material or equipment that requires electrical specifications/connections (circuit breaker, conduit, wire, labor, etc.) different than shown and/or scheduled on the drawings, or specified in detail, the contractor shall be responsible for coordinating any necessary changes and shall bear the cost of such changes (including engineering costs).

1.08 PROPOSAL REQUESTS AND INSTRUCTIONS

- A. For any proposal request or instruction that requires an adjustment to the Contract Sum, submit an itemized quotation for the change(s) described in the proposed modifications to the Contract Documents. Proposal shall also indicate credits, deducts, and/or offsets for material and labor originally included in contract.
 - 1. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. Breakdown shall include amounts, lengths, quantities, types, sizes, etc. of material.
 - 2. Indicate applicable taxes, O&P, delivery charges, equipment rental, and other incidental charges.

3. Include costs of labor and supervision directly attributable to the change.
4. All sub-contractor pricing shall include the same breakdown as described above.

1.09 WARRANTY

- A. All equipment and installation shall be provided with a 1-year warranty beginning with substantial completion.
- B. Refer to individual spec sections for specific warranty information that is different than stated above.
- C. Submit warranty with related forms completed in Owner's name and registered with manufacturer.

1.10 MANUALS

- A. In addition to catalog data and shop drawings submitted for review, this contractor shall furnish Operation and Maintenance Manuals for the mechanical systems. Manuals shall be delivered to the Architect before final observation of the work.
- B. Operation and Maintenance Manuals shall be furnished in PDF electronic format as well as two (2) copies bound in new hard backed 3 ring binders with the title "Operations and Maintenance Manuals" and the project title clearly printed on the front cover and side of binder .
- C. Provide an index at the beginning of the manual for the sections included in the manual. Material shall be listed in specification sequence order.
- D. All sections in hard copy manuals shall be referenced with plastic tabs.
- E. Operation and Maintenance Manuals shall contain:
 1. Approved shop drawings clearly showing the models, sizes and capacities of equipment used.
 2. Manufacturer's operating, parts list, maintenance, installation, lubrication and cleaning instructions.
 3. Factory startup reports, test and balance reports.
 4. Valve tag list.
 5. Name and address of authorized service organization and parts depot.
 6. Chemical Treatment Analysis Reports for heating & cooling systems.
 7. Radiographic Testing Reports of welded pipe with picture of weld & location plan showing physical location of where test was performed.
 8. A description of how the components of a given HVAC system interact within the large system. For example, circulating pumps, boilers, unit heaters are part of the "heating system".
 9. A description of normal operating conditions for the system and its components.
 10. A description of common symptoms of a malfunctioning system and likely causes.
 11. Warranty letter from the automatic temperature controls contractor indicating the warranty period for their portion of the work.
 12. Signed owner instruction forms for all items specified as requiring owners' instruction.
 13. The Systems manual shall have an index and be broken up by individual systems such as "heating", "shop exhaust", "kitchen ventilation and exhaust", "chilled water", "administration ventilation".
 14. Include at the front of the manual a complete listing of the Architect, Engineer and contractors and sub-contractors used on the project. Listing shall include names, addresses and phone numbers for each.
 15. All major pieces of equipment shall be referenced with the equipment supplier's name, address and phone number shall be provided.
- F. Operations and Maintenance Manuals shall be submitted to the Engineer for approval prior to delivery to the Architect.

1.11 INSTRUCTION OF OWNER'S EMPLOYEES

- A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.
- B. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- C. The number of man hours of instruction furnished for each system shall be as specified below. Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 75% of time used for an initial instruction and 25% of time used for a follow up instruction, a minimum of four (4) weeks after initial instruction.
- D. Instruction of Owner's Employees" form at end of this section shall be filled out and signed by Contractor and Owner's Representative and three (3) signed copies of form sent to Engineer.
- E. Owner training and instructions:
 - 1. Heat generation systems including but not limited to boilers, gas fired unit heaters, and ____ shall not be less than two (2) man hours.
 - 2. Refrigeration equipment including but not limited to air cooled condensing units, split systems, and ____ shall not be less than two (2) man hours.
 - 3. Heat transfer systems including but not limited to circulating pumps, terminal heating and or cooling units, and ____ shall not be less than four (4) man hours.
 - 4. Ventilation systems including but not limited to packaged rooftop units, exhaust fans, terminal air units, and ____ shall not be less than four (4) man hours.
 - 5. Automatic temperature control systems including all components of the system shall be not less than eight (8) man hours.

1.12 INSTALLATION OF EQUIPMENT

- A. All appliances and equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications. Auxiliary piping, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.
- B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.
- C. As a part of the work of this contract, the Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, and shall install additional dampers required for correct balance as recommended by air balance agency, at no additional cost to the Owner.
- D. The use of permanent HVAC systems for temporary heating, cooling, ventilating, and conditioning is strictly prohibited without written authorization from the Engineer.

1.13 RECORD DRAWING

- A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.
- B. The contractor shall note on the record drawings the elevations and/or inverts of all mechanical services (i.e., sewer, water, etc.) where they exit the building foundation. The contractor shall also record dimensions from the building to points on all mechanical equipment installed (ie., fuel tanks, oil piping, etc.).
- C. A complete set of these drawings shall be scanned at a resolution of 600dpi in color and saved in an Adobe PDF portfolio format with index to each sheet by name and burned to a non-volatile media. The electronic copy of the as-built drawings shall be transmitted to the Engineer. After review and approval by the Engineer, the as-built drawings will be turned over to the Owner.

1.14 COOPERATION WITH OTHER TRADES

- A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set the piping and/or re-route the duct work where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

1.15 INSPECTION OF SITE

- A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themselves with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.16 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

- A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.17 SALVAGE

- A. All items removed from existing building shall be salvaged in a workmanlike manner.
- B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

1.18 CODES, ORDINANCES, REGULATIONS & STANDARDS

- A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.
- B. All work shall conform to applicable state and local codes, ordinances, regulations and/or standards.

1.19 PERMITS AND LICENSES

- A. This contractor shall obtain and pay for all licenses and permits and shall pay for all fees and charges for the connection to outside services and use of property other than the site of the work for storage of materials or other purposes.
- B. Contractor shall coordinate and request all inspections from authority having jurisdiction. The Contractor shall notify the Architect of all such coordinated inspections (date & time) and shall submit certificates of inspection and final approval of the local inspection authority.

1.20 TESTS

- A. Test all equipment installed under these specifications and demonstrate its proper operation to the Engineer.
- B. Do not test or operate equipment for any purpose, until it has been fully lubricated in accordance with the manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to the piping system with sufficient water so that it will not run dry.
- C. Submit to the Engineer air balance and water balance reports indicating test results as hereinafter specified under Section 230593 "TESTING, ADJUSTING AND BALANCING FOR HVAC".

- D. All testing shall be completed before final inspection, and test results shall be available during the final inspection.

1.21 GUARANTEES

- A. This contractor shall guarantee all equipment, material, and workmanship for a period of one year from date of final certificate. Any defects in mechanical equipment, workmanship or materials that appear, or cause trouble of any kind within a period of one year from date of final certificate shall be remedied, free of charge. Refer to other sections of these specifications for guarantees in excess of the requirements herein described.

1.22 CONSTRUCTION CLOSEOUT DOCUMENTS

- A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an NA where items don't pertain.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 INSTRUCTION TO OWNER'S EMPLOYEES FORM

DATE _____

INSTRUCTION OF OWNER'S EMPLOYEES

This letter shall certify that the Contractor has furnished the Owner with full instructions in the care and operation of all parts of the mechanical system as specified under Section 23 0100 paragraph entitled "Instruction of Owner's Employees".

Section	Owner's Initial Instructions			Owner's Follow-up Instructions		
	Hours	Date	Initials	Hours	Date	Initials
Special Piping						
Heat Generation						
Refrigeration						
Heat Transfer						
Ventilation						
Temperature Control						

3.02 LIST OF CONSTRUCTION CLOSEOUT DOCUMENTS

SECTION	DOCUMENT	DATE/INITIALS	APPROVED
23 01 00	Record drawings - HVAC & Controls		
23 01 00	O&M Manuals - HVAC & Controls		
23 01 00	Owner instruction - HVAC & Controls		

END OF SECTION

SECTION 23 0150 - MECHANICAL MATERIALS & METHODS

PART 1 GENERAL

1.01 APPLICABILITY

- A. This section covers basic materials and methods and applies to and forms a part of each of the sections of Division 23.
- B. This work shall be in accordance with this and other applicable sections and/or provisions of these specifications and with the applicable drawings.

1.02 COORDINATION OF OPENINGS

- A. This contractor shall coordinate all openings required for new piping, ductwork, equipment, controls, etc. through any structural slabs, beams, or walls. Contractor shall request a copy of the precast concrete shop drawings and verify locations and sizes of all openings required.
- B. All costs associated with structural field changes or redesigns of the building systems due to lack of field coordination shall be responsibility of this contractor.

1.03 MATERIALS & MANUFACTURERS

- A. All materials and equipment shall be new, free of defects, installed in accordance with manufacturer's current published recommendations in a neat manner and in accordance with standard practice of the industry.
- B. Certain materials and/or equipment in this specification are specified by manufacturer and catalog numbers. The design was based on the specified equipment and establishes a degree of quality, performance, physical configuration, etc. If the contractor should elect to use equipment other than the equipment used as a basis for design but listed as "acceptable" in the specifications, he shall be responsible for space requirements, configuration, performance, and changes in bases, supports, vibration isolators, structural members, openings in structure and other apparatus that may be affected by its use.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Piping is to be installed as shown on the drawings as much as practical. When a pipe size is not indicated, the subcontractor shall request the pipe size from the Architect through the Mechanical Contractor.
- B. Provide sufficient swing joints, expansion loops, and/or devices necessary and install so as to permit free expansion and contraction of piping without causing undue stresses. Make all changes in direction with fittings. Support piping independently at all equipment so that its weight shall not be supported by the equipment.
- C. Install piping without springing or forcing and clear all windows, doors, and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted.
- D. All pipes shall be reamed to full pipe diameter before joining.
- E. Install vertical risers plumb and straight, horizontal lines parallel with walls and partitions. Conceal piping above ceilings and within furring and/or walls (finished construction).
- F. Provide shut-off valves and unions suitably located to isolate each item of equipment, branch circuit or section of piping.
- G. Provide solid head plugs on any crosses, tees, etc., located in the piping around the boilers.
- H. Provide drain valves at all low points of each system to enable complete drainage. Drain shall consist of a 3/4" ball valve with hose end.
- I. Provide a manual air vent consisting of 1/2" ball valve with hose end installed on a "T" at all high points of each system to enable complete venting.

- J. All piping shall be adequately supported from the building structure with adjustable hangers to maintain uniform grading where required and to prevent sagging or pocketing.
- K. Provide supports between piping and building structure where necessary to prevent swaying.
- L. The use of wire or perforated metal to support pipe will not be permitted.

2.02 SUPPORTING STEEL

- A. Provide structural steel framework for supporting mechanical equipment as required.
- B. All steel work shall be in conformance with the requirements of the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Material shall conform to ASTM A36.

PART 3 EXECUTION

3.01 PROTECTION, DELIVERY AND STORAGE OF MATERIALS

- A. Make provisions for the delivery and storage of materials and make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Protect materials and equipment stored on site from weather and moisture by maintaining factory covers and/or suitable weather-proof coverings. For extended outdoor storage, motors shall be removed from equipment and stored separately.
- C. The open ends of all piping and ductwork shall be covered whenever that system is not being worked on, i.e., end of the workday, completion of a section, etc. Covering shall keep dust, garbage, vermin, and other foreign objects out of the piping or ductwork when the contractor is not on the jobsite.

3.02 CUTTING AND REPAIRING

- A. All holes and penetrations required for the installation of the mechanical equipment shall be by the mechanical contractor. This shall include all piping, ductwork, and any other penetration through the wall, floor, or roof.
- B. Cutting construction shall be done only with the written permission of the Architect. Cutting shall be done carefully and damage to buildings, pipes, wiring, or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional charge to the Owner. This Contractor shall be responsible for all cutting and patching unless such work has been delegated to the General Contractor.
- C. All holes cut into concrete shall be cut by means of power saws or core drills. All unsightly spalls or chips shall be repaired.
- D. All openings remaining around duct and pipe penetrations shall be filled, caulked, and painted to match wall. Code approved fire caulking shall be used for all rated penetrations.

3.03 SEALING FLOOR, CEILINGS AND WALL OPENINGS

- A. Where pipes or ducts pass through walls, ceilings, floors, or partitions, (other than those through fire rated walls or chases) the opening in the construction around the pipe or duct shall not exceed ½ inch average clearance on all sides and shall be sealed to prevent the passage of sound and air. Coordinate wall openings to allow insulation thickness to pass through walls if allowed.
- B. The material used to seal space between the wall and the pipe/duct shall be non-combustible caulk type, or wrap type, as conditions require. Provide sheet metal angles or flanges as may be required to contain the stopping material. Use of expanding foam will be allowed if surfaces are cleaned of an excess material and all edges are trimmed smooth. Penetrations through exterior walls shall be sealed weather tight.
- C. Special attention shall be given to penetrations of mechanical room walls. Fill gaps around entire exterior area of the pipes or ducts with sound insulation (batt or mineral wool) to within ½"

of the wall surface. Use silicone caulking to finish filling the opening smooth with the wall surface or provide sheet metal angles. All sealer shall meet flame spread 25 and smoke developed less than 50.

- D. Where pipes or ducts pass through fire-rated walls, ceilings, floors, vertical service shafts walls, or partitions, the opening in the construction around the pipe or duct shall be fire-stopped to prevent the passage of flame and smoke. All assemblies shall be UL or ASTM listed to provide a fire rating equal to that of the construction being penetrated. For the firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests shall be submitted from the manufacturer to the local authorities having jurisdiction for their review and approval prior to installation. Individuals installing the firestopping shall be experienced and certified as required by the manufacturer whose product is being applied. Refer to firestopping specification section for more information.
- E. Manufacturer's assembly drawings shall be provided in O & M Manuals for each type of penetration. Printed metal or plastic labels shall be permanently applied on the structure within 6" of the edge of the firestop system. Metal labels shall be applied with mechanical fasteners & plastic labels shall be the self-adhering type with adhesive capable of permanently bonding labels to the surfaces on which the labels are placed. The information required on the label include UL/ASTM assembly number, date of installation, fire stopping material manufacture name, Contractor's name, address & phone number & the installer's name.
- F. Duct coverings shall not extend through walls or floors required to be fire-stopped or have a fire resistance rating. Insulation shall be taped or sealed to the walls to eliminate sweating at any fire and/or smoke dampers.
- G. Acceptable manufacturers shall be Hilti, 3M Brand, or a prior approved product.

3.04 CLEANING AND PAINTING

- A. Clear away all debris, surplus materials, etc., resulting from work or operations, leaving the job and equipment furnished under this contract in a clean condition.
- B. All exposed ductwork visible behind grilles, registers or air terminals shall be painted flat black.
- C. All equipment being furnished with finished paint coat shall be examined upon job completion for scratches and other surface damage. All finished surfaces where necessary shall be touched up with touch-up paint of color to match the factory finish.
- D. Paint all exposed bare pipe exterior of the building. Bare pipe shall be painted one coat of No. 7769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Final coat shall be of a color selected by the architect.
- E. Paint all exposed iron and steel work, pipe hangers, pipe stands, uninsulated tanks, supporting steel for equipment and exposed bare pipe in mechanical areas. Iron and steel work and bare pipe shall be painted one coat of No. 4769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Iron and steel work shall be painted black.

3.05 ASBESTOS FREE BUILDING

- A. There shall be no products or building materials used as a temporary or permanent element in the construction of this building, which has in its make-up any form of asbestos. The contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building and remind material suppliers that their products must be asbestos free.
- B. Notify the Architect immediately of any existing materials which are suspected of containing asbestos. Do not disturb or attempt to remove any asbestos containing material. The Architect will contact the Owner and inform them of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos removal.

3.06 HOUSEKEEPING PAD FOR MACHINERY (BY MECHANICAL)

- A. Housekeeping Pad Sub-bases shall be provided for all machinery such as air handlers, pumps, and/or where called out on plans.
- B. Housekeeping pads shall be a minimum of 4-inches thick and shall follow all manufacturer's instructions and requirements for support.

3.07 SALVAGE

- A. All items removed from existing building shall be salvaged in a workmanlike manner.
- B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

END OF SECTION

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.
- E. Electronically Commutated Motors (ECM).

1.02 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.
- C. NEMA MG 00001 - Motors and Generators; 2024.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Closeout Documents:
 - 1. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Allis Chalmers
- B. Baldor Electric Company/ABB Group: www.baldor.com.
- C. Emerson
- D. General Electric
- E. Marathon
- F. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com.
- G. Reliance
- H. Westinghouse

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service:
 - 1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
 - 2. Motors Larger than 1/2 Horsepower: 240 V, 60 Hz
- B. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 degrees F environment.
 - 3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.
 - 4. All motor shall be premium efficiency type.
- C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- D. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

- A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.
- B. Motors located in explosion proof environments and dust collection systems: Totally enclosed type explosion proof.
- C. Motors located in exterior locations, air cooled condensers, humidifiers, direct drive axial fans, and roll filters: Totally enclosed type.
- D. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.
- E. Motors driven by Variable Frequency Drives shall in be listed for the application.

2.04 SHAFT GROUNDING

- A. All motors over 1 HP on variable frequency drives shall be equipped with shaft grounding system to discharge shaft voltage potential to ground. Motors on variable frequency drives shall be bonded from the motor foot to system ground with high frequency grounding strap consisting on tinned, copper strap with terminations to accommodate the motor foot and system ground.

2.05 SINGLE PHASE POWER - SPLIT PHASE MOTORS

- A. Starting Torque: Less than 150 percent of full load torque.
- B. Starting Current: Up to seven times full load current.
- C. Breakdown Torque: Approximately 200 percent of full load torque.
- D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
- E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.

- C. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
- E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.
- D. Insulation System: NEMA Class B or better.
- E. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
- F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- G. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- H. Sound Power Levels: To NEMA MG 00001.
- I. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
- J. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- K. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.08 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. . Electronically Commutated Motor
 - 1. Motor to be a DC electronic commutation type motor (ECM) specifically designed for application.
 - 2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - 3. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
 - 4. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 23 0523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Globe valves.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.
- E. Gate valves.
- F. Chainwheels.

1.02 REFERENCE STANDARDS

- A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding; 2022.
- B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- F. ASME B31.9 - Building Services Piping; 2020.
- G. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
- I. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service; 2021.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
- K. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017 (Reapproved 2025).
- L. AWWA C606 - Grooved and Shouldered Joints; 2015.
- M. MSS SP-45 - Drain and Bypass Connections; 2020.
- N. MSS SP-67 - Butterfly Valves; 2022.
- O. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
- P. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
- Q. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
- R. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
- S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Closeout Documents:

1. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

- A. Manufacturer:
 1. Obtain valves for each valve type from single manufacturer.
 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 2. Protect valve parts exposed to piped medium against rust and corrosion.
 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 5. Secure check valves in either the closed position or open position.
 6. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.
- C. Exercise the following precautions for handling:
 1. Handle large valves with sling, modified to avoid damage to exposed parts.
 2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- C. Provide the following valves for the applications if not indicated on drawings:
 1. Throttling (Hydronic): Butterfly, Ball, and Globe.
 2. Throttling (Steam): Globe.
 3. Isolation (Shutoff): Butterfly, Gate, and Ball.
 4. Swing Check (Pump Outlet):
 - a. Size 2 inch and Smaller: Bronze with bronze disc.
 - b. 2-1/2 NPS and Larger: Iron with center-guided metal or center-guided with resilient seat.
 5. Dead-End: Butterfly, single-flange (lug) type.
- D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- E. Required Valve End Connections for Non-Wafer Types:
 1. Steel Pipe:
 - a. Size 2 inch and Smaller: Threaded ends.
 - b. 2-1/2 NPS and Larger: Grooved or flanged ends.
 2. Copper Tube:

- a. Size 2 inch and Smaller: Threaded ends, except solder-joint valve-ends.
 - b. Size 2-1/2 inch and Larger: Grooved ends.
- 3. Steam and Steam Condensate Pipe: Grooved ends not acceptable.
- F. Chilled Water Valves:
 - 1. 2 NPS and Smaller, Bronze Valves:
 - a. Threaded or soldered ends.
 - b. Ball: Full port, two piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. Ball: 2-1/2 NPS to 10 inch, Class 150.
 - b. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
 - c. Single-Flange Butterfly: 14 inch to 24 inch, aluminum-bronze disc, EPDM seat, 150 CWP.
 - d. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
 - e. Swing Check: Metal seats, Class 125.
 - f. Swing Check with Closure Control: 2-1/2 inch to 12 inch, lever and spring, Class 125.
 - g. Grooved-End Check: 3 inch to 12 inch, 300 CWP.
 - h. Plate-Type Check: Single plate, metal seat, Class 125.
 - i. Gate: NRS, Class 125.
- G. Heating Hot Water Valves:
 - 1. 2 NPS and Smaller, Bronze Valves:
 - a. Threaded or soldered ends.
 - b. Ball: Full port, two piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 - d. Gate: NRS, Class 125.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 inch to 4 inch: Threaded or flanged ends.
 - b. Ball: 2-1/2 inch to 10 inch, Class 150.
 - c. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
 - d. Single-Flange Butterfly: 14 inch to 24 inch, aluminum-bronze disc, EPDM seat, 150 CWP.
 - e. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
 - f. Swing Check: Metal seats, Class 125.
 - g. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure control, Class 125.
 - h. Grooved-End Swing Check: 3 inch to 12 inch, 300 CWP.
 - i. Plate-Type Check: Single plate, metal seat, Class 125 .
 - j. Gate: NRS, Class 125.
- H. Low Pressure Steam Valves for Pressures of 15 psi or Less:
 - 1. 2 NPS and Smaller, Bronze and carbon steel Valves:
 - a. Ball: Full port, two piece, stainless steel trim.
 - b. Swing Check: Bronze disc, Class 125.
 - c. Gate: NRS, Class 125.
 - d. Globe: Bronze disc, Class 125.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 NPS to 4 NPS: Flanged ends.
 - b. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure. control, Class 125.
 - c. Gate: NRS, Class 125.
 - d. Globe: 2-1/2 inch to 12 inch: Class 125.

- I. High Pressure Steam Valves (Greater than 15 PSIG):
 - 1. 2 NPS and Smaller, Carbon Steel Valves:
 - a. Gate: RS, Class 150.
 - b. Globe: Bronze disc, Class 150.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 NPS to 4 NPS: Flanged ends.
 - b. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure control, Class 125.
 - c. Gate: OSY, Class 150.
 - d. Globe: 2-1/2 NPS to 12 NPS, Class 150.
- J. Steam-Condensate Valves:
 - 1. 2 NPS and Smaller, Bronze and Carbon Steel Valves:
 - a. Gate: NRS and RS, Class 150.
 - b. Ball: Full port, three piece, stainless steel trim.
 - c. Globe: Bronze disc, Class 150.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. Provide 2-1/2 NPS to 4 NPS with flanged ends.
 - b. Swing Check: Lever and weight closure control, Class 125.
 - c. Gate: OSY, Class 150.
 - d. Globe: 2-1/2 NPS to 12 NPS, Class 150.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 - 1. Gear Actuator: Quarter-turn valves 8 inch and larger.
 - 2. Handwheel: Valves other than quarter-turn types.
 - 3. Hand Lever: Quarter-turn valves 6 NPS and smaller.
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
 - 1. Gate Valves: Rising stem.
 - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: Extended neck.
 - 4. Memory Stops: Fully adjustable after insulation is installed.
- E. Memory Stops: Fully adjustable after insulation is installed.
- F. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 - 3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
 - 4. Solder Joint Connections: ASME B16.18.
 - 5. Grooved End Connections: AWWA C606.
- G. General ASME Compliance:
 - 1. Building Services Piping Valves: ASME B31.9.
- H. Bronze Valves:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

- I. Valve Bypass and Drain Connections: MSS SP-45.
- J. Source Limitations: Obtain each valve type from a single manufacturer.
- K. Press-Fit Valve Manufacturers
 - 1. Watts
 - 2. Viega
 - 3. Milwaukee
 - 4. Apollo
 - 5. NIBCO
- L. Valve Manufacturers (unless otherwise noted)
 - 1. Apollo Valves
 - 2. NIBCO
 - 3. Milwaukee
 - 4. Hammond
 - 5. Jomar
 - 6. Watts
 - 7. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BRONZE, GLOBE VALVES

- A. CWP Rating: Class 125: 200 psi:
 - 1. Comply with MSS SP-80, Type 1.
 - 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 - 3. Ends: Threaded or solder joint.
 - 4. Packing: Asbestos free.
 - a. Handwheel: Malleable iron.

2.04 IRON, GLOBE VALVES

- A. CWP Ratings: Class 125: 200 psi and Class 250: 500 psi:
 - 1. Comply with MSS SP-85, Type I.
 - 2. Body: Gray iron; ASTM A126, with bolted bonnet.
 - 3. Ends: Flanged.
 - 4. Trim: Bronze.
 - 5. Packing and Gasket: Asbestos free.
 - 6. Operator: Handwheel or chainwheel.

2.05 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Bronze or Brass Trim:
 - 1. Comply with MSS SP-110.
 - 2. Stem: Bronze or brass.
 - 3. Ball: Chrome plated brass.
- C. Three Piece, Full Port with Stainless Steel Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. CWP Rating: 600 psi.
 - 4. End Connections: Pipe thread.
 - 5. Seats: PTFE.
 - 6. Stem: Stainless steel.
 - 7. Ball: Stainless steel, vented.

2.06 CARBON STEEL, BALL VALVES

2.07 IRON, BALL VALVES

- A. Split Body, Full Port:
 - 1. Comply with MSS SP-72.
 - 2. CWP Rating: 200 psi.
 - 3. Body: ASTM A126, gray iron.
 - 4. Ends: Flanged.
 - 5. Seats: PTFE.
 - 6. Stem: Stainless steel.
 - 7. Ball: Stainless steel.

2.08 IRON, GROOVED-END BALL VALVES

- A. Class 200:
 - 1. CWP Rating: 600 psi.
 - 2. Body: Ductile iron; ASTM A536, Grade 65-45-12.
 - 3. Ends: Grooved.
 - 4. Seats: Teflon.
 - 5. Stem: Nickel plated carbon steel.
 - 6. Ball: Nickel plated carbon steel or Type 304 stainless steel.

2.09 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style:
 - 1. Comply with MSS SP-67, Type I.
 - 2. Lug Style, CWP Ratings:
 - a. Sizes 2 to 12 inch: 150 psi.
 - b. 250 psi Sizes 14 to 24 inch: 250 psi.
 - c. Vacuum Service: Down to 29.9 in-Hg.
 - 3. Body: Ductile iron.
 - 4. Stem: One or two-piece stainless steel.
 - 5. Disc: Aluminum-bronze.
 - 6. Manufacturers:
 - a. Apollo Valves
 - b. NIBCO
 - c. Milwaukee
 - d. Hammond
 - e. Jomar
 - f. Watts
 - g. Victaulic
 - h. Gruvlok
 - i. Substitutions: See Section 01 6000 - Product Requirements.

2.10 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psi.
 - 1. Comply with MSS SP-67, Type I.
 - 2. Body: Ductile iron.
 - 3. Stem: Two-piece stainless steel.
 - 4. Disc: Aluminum-bronze.
 - 5. Disc Seal: EPDM.

2.11 BRONZE, LIFT CHECK VALVES

- A. Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psi.
3. Design: Vertical flow.
4. Body: Bronze.
5. Ends: Threaded.
6. Disc (Type 1): Bronze.
7. Disc (Type 2): PTFE.
8. Manufacturers
 - a. Apollo Valves
 - b. NIBCO
 - c. Milwaukee
 - d. Hammond
 - e. Jomar
 - f. Watts
 - g. Substitutions: See Section 01 6000 - Product Requirements.

2.12 BRONZE, SWING CHECK VALVES

- A. Class 125:
 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 2. Design: Y-pattern, horizontal or vertical flow.
 3. WSP Rating: 200 psi.
 4. Body: Bronze, ASTM B62.
 5. End Connections: Threaded or soldered.
 6. Disc: Bronze.

2.13 IRON, FLANGED END SWING CHECK VALVES

- A. Class 125:
 1. 200 psi with metal seats and nonmetallic-to-metal seats.
- B. Characteristics
 1. Comply with MSS SP-71, Type I.
 2. Design: Clear or full waterway with flanged ends.
 3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
 4. Trim: Bronze.
 5. Disc Holder: Bronze.
 6. Disc: PTFE or TFE.
 7. Gasket: Asbestos free.
- C. Manufacturers:
 1. Apollo Valves
 2. NIBCO
 3. Milwaukee
 4. Hammond
 5. Jomar
 6. Watts
 7. Substitutions: See Section 01 6000 - Product Requirements.

2.14 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125:
 1. Comply with MSS SP-71, Type I.
 2. Body Design: Clear or full waterway.
 3. Body Material: ASTM A126, gray iron with bolted bonnet.
 4. Ends: Flanged.

5. Trim: Bronze.
6. Gasket: Asbestos free.
7. Closer Control: Factory installed, exterior lever, and spring.
8. Manufacturers:
 - a. Apollo Valves
 - b. NIBCO
 - c. Milwaukee
 - d. Hammond
 - e. Jomar
 - f. Watts
 - g. Substitutions: See Section 01 6000 - Product Requirements.

2.15 IRON, GROOVED-END SWING CHECK VALVES

- A. Class 300:
 1. CWP Rating: 300 psi.
 2. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
 3. Coating: Black, non-lead paint.

2.16 IRON, PLATE-TYPE CHECK VALVES

- A. Class 125 Single-Plate:
 1. Comply with API STD 594.
 2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
 3. Sizes 14 to 24 inch: CWP Rating; 150 psi.
 4. Body Design: Wafer, spring-loaded plate.
 5. Body Material: ASTM A126, gray iron.
 6. Resilient Seat: EPDM or NBR.

2.17 BRONZE, GATE VALVES

2.18 IRON, GATE VALVES

2.19 CHAINWHEELS

- A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 2. Attachment: For connection to ball, butterfly, and Gate valve stems.
 3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
 4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.
- D. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Lift Check: Install with stem plumb and vertical.
 - 2. Swing Check: Install horizontal maintaining hinge pin level.
 - 3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.
- E. Provide chainwheels on operators for valves 4 inch NPS and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed duct markers.
- D. Pipe/Duct markers.
- E. Ceiling markers/tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide manufacturers catalog literature for each product required.
- C. Closeout Documents:
 - 1. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
 - 2. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Nameplates.
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Dampers: Ceiling tacks, where located above lay-in ceiling.
- F. Ductwork: Duct Markers.
- G. Heat Transfer Equipment: Nameplates.
- H. Instrumentation: Tags.
- I. Major Control Components: Nameplates.
- J. Piping: Pipe Markers.
- K. Pumps: Nameplates.
- L. Tanks: Nameplates.
- M. Thermostats: Nameplates.
- N. Valves: Tags and/or ceiling tacks where located above a finished ceiling..

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
 - 4. Seton Identification Products, a Tricor Direct Company: www.seton.com.

- 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Letter Color: White.
- C. Letter Height: 1/2 inch.
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
 - 5. Seton Identification Products, a Tricor Company: www.seton.com.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.
- C. Style: Individual Label.
- D. Color:
 - 1. Green with white letters: For cold-air supply ducts.
 - 2. Yellow with black letters: For hot-air supply ducts.
 - 3. Blue with white letters: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

2.05 PIPE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 5. Seton Identification Products, a Tricor Company: www.seton.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Color: Comply with ASME A13.1.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Provide sticker/tape with flow arrows around the circumference of the piping at each end of pipe marker to hold marker in place.
- D. Color code as follows:
 - 1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
 - 2. Toxic and Corrosive Fluids: Orange with black letters.
 - 3. Compressed Air: Blue with white letters.
 - 4. Flammable and oxidizing fluids: Yellow with black letters.

2.06 CEILING TACKS/MARKERS

- A. Manufacturers:
 - 1. Craftmark: www.craftmarkid.com.
 - 2. Moore
 - 3. Seton
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Sticker with 3/4 inch diameter color coded head.
 - 1. Color code as follows:
 - a. Fire Dampers and Smoke Dampers: Red.
 - b. Heating/Cooling Valves: Yellow.
 - c. Flammable Fluid Valves:

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Piping shall be identified as to contents using the following list:

Glycol Hot Water Heating Supply	GHWS
Glycol Hot Water Heating Return	GHWR
Hot Water Heating Supply	HWS
Hot Water Heating Return	HWR
Condensate	COND.
Chilled Water Supply	CHWS
Chilled Water Return	CHWR
Natural Gas	NAT GAS
Refrigerant Liquid	RL
Refrigerant Suction	RS
- B. Ductwork shall be identified as indicated below. Ductwork label shall also include the equipment served.

Supply Air	Supply
Return Air	Return
Exhaust Air	Exhaust
Outside Air	Outside
Relief Air	Relief
Grease Exhaust Air	Grease Exhaust
- C. Valves controlling mains, risers and branches, but not individual shut-off or local control valves on equipment, shall be identified by a tag. Schedules, framed under glass and mounted where directed, shall be provided showing a complete listing of all valve tags and giving numbers, locations, and color codes, if any, of pipes controlled. Frames shall be secured to wall by not less than four screws. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- D. Install tags with corrosion resistant chain.
- E. Install plastic pipe and duct markers in accordance with manufacturer's instructions.
- F. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

- G. Equipment serving different areas of a building other than where they are installed shall be permanently marked in an approved manner that uniquely identifies the equipment and the area it serves.
- H. Locate duct markers where ductwork is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:
 - 1. Near each damper.
 - 2. Near each branch connection. Mark flow direction at each branch.
 - 3. On both sides of penetrations through walls, floors, ceilings, and non-accessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed ductwork.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in congested areas where ductwork is partially hidden by other pipe, ductwork or equipment.
 - 7. On both sides of every change in direction.
 - 8. When several ducts from different units are located in concealed congested areas, locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
 - 9. Provide a minimum one label per pipe/duct per room. Where pipes are racked, install pipe markers on each pipe in the same location to aid in differentiating each pipe in the rack.
- I. For insulated pipe/duct, marker size shall be based on insulation size, not pipe/duct size.
 - 1. Identify service, flow direction, and pressure.
- J. Locate ceiling tacks/markers to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic and Domestic Water systems.
- C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024, with Errata (2025).
- C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.03 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent who conforms to the standards set forth by either AABC, NEBB or TABB.

1.04 PREINSTALLATION CONFERENCE

- A. Testing, Adjusting and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. Contract Documents examination report.
 - c. Testing, adjusting, and balancing plan.
 - d. Work schedule and Project site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.

1.05 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing adjusting and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.06 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Prior to testing, adjusting and balancing the system, the Contractor shall submit 2 copies of the proposed test report forms for engineer's approval.
 - 2. Certified Testing, Adjusting and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

3. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.. Submit 2 copies of the NEBB or AABC certificate for each member of the testing, adjusting, and balancing Agent team
4. TAB Plan: Submit 2 copies of a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - a. Submit to Engineer.
5. Include at least the following in the plan:
 - a. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - b. Identification and types of measurement instruments to be used and their most recent calibration date.
 - c. Final test report forms to be used.
 - d. Procedures for formal deficiency reports, including scope, frequency and distribution.
- C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- D. Closeout Documents:
 1. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - a. Units of Measure: Report data in I-P (inch-pound) units only.
 - b. Include the following on the title page of each report:
 - 1) Name of Testing, Adjusting, and Balancing Agency.
 - 2) Address of Testing, Adjusting, and Balancing Agency.
 - 3) Telephone number of Testing, Adjusting, and Balancing Agency.
 - 4) Project name.
 - 5) Project location.
 - 6) Project Engineer.
 - 7) Project Engineer.
 - 8) Project Contractor.
 - 9) Project altitude.
 - 10) Report date.
 - 11) Signature of testing, adjusting, and balancing Agent who certifies the report.
 - c. In addition to the certified field report data, include the following;
 - 1) Pump curves,
 - 2) Fan curves.
 - d. Summary of contents, including the following:
 - 1) Design versus final performance.
 - 2) Notable characteristics of systems.
 - e. Description of system operation sequence if it varies from the Contract Documents.
 - f. Notes to explain why certain final data in the body of reports vary from design values.
 2. Instrument Calibration Reports: For instrument calibration, include the following:
 - a. Instrument type and make
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
 3. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.07 WARRANTY

- A. Test and balance agency shall include an extended warranty of 90 days, after completion of the test and balance work, during which time the Engineer at his discretion may request a recheck, or resetting of any outlet, supply air fan, or exhaust fan as listed in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 - 4. SMACNA (TAB).
 - 5. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guarantee.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
 - 2. Systems are started and operating in a safe and normal condition.
 - 3. Temperature control systems are installed complete and operable.
 - 4. Proper thermal overload protection is in place for electrical equipment.
 - 5. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 6. Duct systems are clean of debris.
 - 7. Fans are rotating correctly.
 - 8. Fire and volume dampers are in place and open.
 - 9. Air coil fins are cleaned and combed.

10. Access doors are closed and duct end caps are in place.
 11. Air outlets are installed and connected.
 12. Duct system leakage is minimized.
 13. Hydronic systems are flushed, filled, and vented.
 14. Pumps are rotating correctly.
 15. Proper strainer baskets are clean and in place.
 16. Service and balance valves are open.
 17. Examine automatic temperature system components to verify the following:
 - a. Dampers, valves, and other controlled devices operate by the intended controller.
 - b. Dampers and valves are in the position indicated by the controller.
 - c. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes, and variable-air-volume terminals.
 - d. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 - e. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - f. Sensors are located to sense only the intended conditions.
 - g. Sequence of operation for control modes is according to the Contract Documents
 - h. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - i. Interlocked systems are operating.
 - j. Changeover from heating to cooling mode occurs according to design values.
 18. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project record documents described in Division 1 Section "Project Record Documents."
- D. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems-Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- E. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- F. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Any changing of pulley sizes if found necessary when testing systems, shall be done by this contractor. Any additional dampers which may be found necessary to get proper air supply and quantity shall be furnished by this contractor at no expense to the Owner
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.

7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.04 ADJUSTMENT TOLERANCES

- A. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 1. Running log of events and issues.
 2. Discrepancies, deficient or uncompleted work by others.
 3. Contract interpretation requests.
 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- 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 the 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. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- M. Balancing dampers shall be adjusted to minimize noise through VAV box by adjusting the balancing damper as required so the motorized damper in the VAV box is no greater than 25% closed to achieve minimum design airflow rate. Balancing damper handles shall be secured once balancing is completed to ensure dampers will remain in place after balancing is complete. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- O. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or 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 the system.
- C. Adjust systems to provide 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 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, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 VARIABLE FREQUENCY DRIVES/ECM MOTORS

- A. Variable Frequency Drives (VFD) and/or ECM motors are installed on some of the fans on the job. Each fan VFD/ECM motor may be used to balance the airflow. The fan shall be resheaved as necessary to have the balanced airflow discharged with the VFD set at 60 Hz (ECM motor at 100%). Coordinate resheaving necessary with Mechanical Contractor
- B. Variable Frequency Drives (VFD) and/or ECM motors are installed on some of the pumps on the job. Each pump VFD/ECM motor may be used to balance the waterflow. False head shall not be placed on the system with a balancing valve in order to get the pump to run at 60 Hz/100%.

3.09 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

3.10 PRESSURE TESTING OF DUCTWORK

- A. The balancing subcontractor shall be responsible for pressure test verification of the entire ventilation system for leakage. Supply all necessary equipment to pressure test duct work. Pressure testing shall take place during construction as required, in accordance with Section 23 3100
- B. Testing supply, return and exhaust duct work shall be done as follows: After the duct work is fabricated and installed, it shall be isolated in sections and tested for air tightness. The air pressure used for the test shall match that specified under Section 23 3100. The ductwork shall be tested to a pressure class A as described per SMACNA. The ductwork shall be tested so that the sealing of the ductwork shall be a leakage class 6. This means that 6 CFM of leakage per 100 sq ft of duct surface is the maximum allowable threshold if tested at 1 inch test pressure. See additional duct sealing requirements in the latest edition SMACNA manual "HVAC Air Duct Leakage Test Manual." Do this prior to applying any thermal insulation. In testing for air tightness, the main trunk shall be first tested by blanking off all branch take-offs, then each branch shall be tested individually after main trunk is proven to be air tight. No equipment connections shall be made on ends of branches until after testing. Ends and other branches shall be blanked off with air tight seals made of galvanized blanks taped in place or other approved methods. Soap solution brushed on shall be used where necessary to detect small leaks.
- C. The balancing contractor performing the leakage testing shall utilize a small scale drawing to show which ductwork corresponds to the duct testing data. This drawing shall individually number each section of ductwork being tested and be included in the final duct pressure testing and balancing report.
- D. Duct pressure testing report shall include the following information:
 - 1. The date of the test.
 - 2. The project name.
 - 3. A description of the duct being tested (identification of duct from small scale plan as called out above), sealing classification and duct classification.
 - 4. The design and actual test static pressures.
 - 5. The design and actual leakage rate.
 - 6. Calculation of duct leakage rate.
 - 7. If the duct passed or failed.
 - 8. Description of the apparatus utilized during testing including orifice size, manufacturer and date calibrated.
 - 9. The actual orifice pressure drop with the actual flow.
 - 10. The name of the person performing the test and any witnesses.

3.11 SCOPE

- A. Test, adjust, and balance the following:
 - 1. HVAC Pumps.
 - 2. Air Cooled Water Chillers.
 - 3. Packaged Roof Top Heating/Cooling Units.
 - 4. Packaged Terminal Air Conditioning Units.
 - 5. Unit Air Conditioners.
 - 6. Air Coils.
 - 7. All flow meters.
 - 8. Air Handling Units.
 - 9. Fans.
 - 10. Air Filters.
 - 11. Air Terminal Units.
 - 12. Air Inlets and Outlets.

3.12 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.
 - 4. Phase, voltage, amperage; nameplate, actual, no load.
 - 5. RPM.
 - 6. Service factor.
 - 7. Starter size, rating, heater elements.
 - 8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
 - 1. Identification/location.
 - 2. Required driven RPM.
 - 3. Driven sheave, diameter and RPM.
 - 4. Belt, size and quantity.
 - 5. Motor sheave diameter and RPM.
 - 6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
 - 1. Identification/number.
 - 2. Manufacturer.
 - 3. Size/model.
 - 4. Impeller.
 - 5. Service.
 - 6. Design flow rate, pressure drop, BHP.
 - 7. Actual flow rate, pressure drop, BHP.
 - 8. Discharge pressure.
 - 9. Suction pressure.
 - 10. Total operating head pressure.
 - 11. Shut off, discharge and suction pressures.
 - 12. Shut off, total head pressure.
- D. Chillers:
 - 1. Identification/number.
 - 2. Manufacturer.
 - 3. Capacity.
 - 4. Model number.
 - 5. Serial number.
 - 6. Evaporator entering water temperature, design and actual.
 - 7. Evaporator leaving water temperature, design and actual.
 - 8. Evaporator pressure drop, design and actual.
 - 9. Evaporator water flow rate, design and actual.
 - 10. Condenser entering water temperature, design and actual.
 - 11. Condenser pressure drop, design and actual.
 - 12. Condenser water flow rate, design and actual.
- E. Cooling Coils:
 - 1. Identification/number.
 - 2. Location.
 - 3. Service.
 - 4. Manufacturer.
 - 5. Air flow, design and actual.
 - 6. Entering air DB temperature, design and actual.

7. Entering air WB temperature, design and actual.
 8. Leaving air DB temperature, design and actual.
 9. Leaving air WB temperature, design and actual.
 10. Saturated suction temperature, design and actual.
 11. Air pressure drop, design and actual.
- F. Heating Coils:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Water flow, design and actual.
 7. Water pressure drop, design and actual.
 8. Entering water temperature, design and actual.
 9. Leaving water temperature, design and actual.
 10. Entering air temperature, design and actual.
 11. Leaving air temperature, design and actual.
 12. Air pressure drop, design and actual.
- G. Air Moving Equipment:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Arrangement/Class/Discharge.
 6. Air flow, specified and actual.
 7. Return air flow, specified and actual.
 8. Outside air flow, specified and actual.
 9. Total static pressure (total external), specified and actual.
 10. Inlet pressure.
 11. Discharge pressure.
 12. Sheave Make/Size/Bore.
 13. Number of Belts/Make/Size.
 14. Fan RPM.
- H. Return Air/Outside Air:
1. Identification/location.
 2. Design air flow.
 3. Actual air flow.
 4. Design return air flow.
 5. Actual return air flow.
 6. Design outside air flow.
 7. Actual outside air flow.
 8. Return air temperature.
 9. Outside air temperature.
 10. Required mixed air temperature.
 11. Actual mixed air temperature.
 12. Design outside/return air ratio.
 13. Actual outside/return air ratio.
- I. Exhaust Fans:
1. Location.
 2. Manufacturer.

3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Sheave Make/Size/Bore.
 10. Number of Belts/Make/Size.
 11. Fan RPM.
- J. Terminal Unit Data:
1. Manufacturer.
 2. Type, constant, variable, single, dual duct.
 3. Identification/number.
 4. Location.
 5. Model number.
 6. Size.
 7. Minimum static pressure.
 8. Minimum design air flow.
 9. Maximum design air flow.
 10. Maximum actual air flow.
 11. Inlet static pressure.
- K. Air Distribution Tests:
1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Area factor.
 6. Design velocity.
 7. Design air flow.
 8. Test (final) velocity.
 9. Test (final) air flow.
 10. Percent of design air flow.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufinsulation.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 250 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufinsulation.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com/sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent.
 - 4. Maximum Density: 8.0 pcf.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.04 DUCT LINER

- A. Manufacturers:
 - 1. Armacell LLC: www.armacell.us/#sle.
 - 2. Knauf Insulation: www.knaufinsulation.com.
 - 3. Johns Manville: www.jm.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flexible duct liner shall be installed in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (latest edition) except as modified herein.
- C. Duct liner shall have a minimum sound absorption coefficient of .55 at 1/2" thickness, factory applied edge coating, shall not support mold or fungus growth, shall meet U.L. #181 erosion test
- D. The air stream surface mat of all duct liner shall be treated with an EPA registered anti microbial agent to prevent fungal or bacterial growth.
- E. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
 - 1. Fungal Resistance: No growth when tested according to ASTM G21.

2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
3. Service Temperature: Up to 250 degrees F.
4. Density: 1-1/2 pound.
5. Minimum Noise Reduction Coefficients:
 - a. 1/2 inch Thickness: 0.30.
 - b. 1 inch Thickness: 0.45.
 - c. 1-1/2 inches Thickness: 0.60.
 - d. 2 inch Thickness: 0.70.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Supply duct shall mean all supply ducts from air handling unit discharge to air outlet (diffuser, register, etc.). This includes all non insulated devices such as terminal coils, distribution boxes, air flow measuring stations, sound attenuators, linear slot plenums, etc. installed in the supply or return duct system. Duct insulation shall extend uninterrupted through all walls with the exception of those containing fire and/or smoke dampers. Coordinate with the installing mechanical contractor(s) at the start of the project to ensure holdouts in walls, where required, are oversized to allow for full insulation thickness to be applied.
- D. All supply ducts passing through spaces without ceilings and not feeding that space shall be insulated as specified.
- E. HVAC ductwork routed exposed in the area it serves shall not be insulated with the following exceptions:
 1. High temperature process air ductwork shall be insulated as described above.
 2. Ductwork with air temperatures below 50 degrees F shall be insulated as described elsewhere in this section.
 3. HVAC ductwork in spaces with garage door openings directly to the building exterior shall be insulated as described above.
- F. Dedicated outdoor air ductwork inside the building envelope, after the make-up air devices with heating & cooling coils, burners, etc., does not require insulation when the air is tempered to room neutral air conditions (approx. 72°F) and used for ventilation purposes only. All non-tempered, outdoor air shall be insulated in the thickness & density described above.
- G. Insulated ducts conveying air above and below ambient temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- H. Ducts Exposed in Mechanical Equipment Rooms or ducts exposed in all other spaces (below 8-feet above finished floor): Finish with rigid fiberglass.
- I. Glass fiber - flexible installation:
 1. End and longitudinal joints shall be butted firmly and lapped and sealed by adhesive.
 2. Mechanical fasteners shall be installed on sides and bottom of ducts spaced at the rate of not less than one fastener per two lineal feet.

3. A single mechanical fasteners shall be installed on any duct width of 24" or larger, two fasteners for 48" or larger, three fasteners for 72" or larger, etc.
 4. At all joints, the vapor barrier jackets shall be covered with 5" wide pressure sensitive vapor seal tape, or shall have 2.5" wide laps drawn tight, stapled, and secured with vapor barrier adhesive.
 5. The joints and all openings where facing is pierced or punctured by pins, staples, etc. shall be coated with two inch wide strips of vapor barrier coating compound.
- J. Glass fiber - rigid installation:
1. Rigid board fiberglass shall be furnished with a reinforced foil faced vapor barrier jacket. Insulation shall be protected at corners and edges with metal corner strips or clips.
- K. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
 2. Seal and smooth joints. Seal and coat transverse joints.
 3. Seal liner surface penetrations with adhesive.
 4. Where duct liner is installed in ducts, the duct size indicated accommodates the liner such that the gross duct dimension is that shown on the drawings. No increase in duct size is necessary to accommodate duct liner thickness.
 5. Casings requiring insulation on the inside shall have liner adhered to all sides of casing with a minimum of 50% coverage of adhesive. In addition, use mechanical fasteners such as Graham Welding Pins, Tuff-Weld Nylon hangers or Stick-Klips on maximum of 16" centers at top and sides. Caulk all joints with fire-retardant mastic to keep moving air from getting behind insulation.

3.03 SCHEDULES

A. Air Handling Units

Ductwork System	Insulation Type	Insulation Thickness	Density
Supply Duct	Glass fiber flexible	2.2 inch (R value - 6)	3/4 lb/ft ³
Return Duct	None	None	None
Mixed Air Duct	Glass fiber flexible	2 inch	1-1/2 lb/ft ³
Outdoor Air Duct	Glass fiber rigid	3 inch	3 lb/ft ³
Relief Duct	Glass fiber flexible	2 inch	1-1/2 lb/ft ³

B. Energy Recovery Units

Ductwork System	Insulation Type	Insulation Thickness	Density
Supply Duct	Glass fiber flexible	2.2 inch (R value - 6)	3/4 lb/ft ³
Exhaust Air Duct from unit outlet to building outlet	Glass fiber flexible	2 inch	1-1/2 lb/ft ³
Outdoor Air Duct	Glass fiber rigid	3 inch	3 lb/ft ³

C. Exhaust Fan Ductwork

Ductwork System	Insulation Type	Insulation Thickness	Density
Exhaust Duct 10 feet back from isolation damper	Glass fiber flexible	2 inch	1-1/2 lb/ft ³

- D. **Mechanical Room Ductwork** (tops of ducts may be 2" foil faced fiberglass in lieu of rigid only with approval from the engineer prior to the installation.)

Ductwork System	Insulation Type	Insulation Thickness	Density
Supply Duct	Glass fiber rigid	2 inch	3 lb/ft ³

Return Duct	None		
Mixed Air Duct	Glass fiber rigid	2 inch	3 lb/ft ³
Outdoor Air Duct	Glass fiber rigid	3 inch	3 lb/ft ³
Combustion Air Duct	Glass fiber rigid	3 inch	3 lb/ft ³
Exhaust Air Duct	Glass fiber rigid	2 inch	3 lb/ft ³
Relief Duct	Glass fiber rigid	2 inch	1-1/2 lb/ft ³

E. Duct Liner

1. All transfer air ducts.
2. All ducts as indicated by cross-hatching or as noted on the drawings.
3. Liner types for the various surfaces shall be as follows:
 - a. Return air ductwork shall be lined with 1" thick coated fiberglass flexible duct liner.
 - b. Transfer air ductwork shall be lined with 1" thick coated fiberglass flexible duct liner.
 - c. Heat pump supply ducts shall be lined with 1" thick coated fiberglass flexible duct liner.

END OF SECTION

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
- C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2024).
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Knauf Insulation: www.knaufinsulation.com.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.

3. Maximum Moisture Absorption: 0.2 percent by volume.
4. Density 4 lb.
- C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 1. K Value: ASTM C177, 0.23 at 75 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 JACKETING AND ACCESSORIES

- A. PVC Plastic.
 1. Manufacturers:
 - a. Johns Manville Zeston 2000 Series White PVC or equal.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Connections: Brush on welding adhesive.
- B. Aluminum Jacket (Exterior Applications):
 1. Manufacturers:
 - a. Ideal Tape Co..
 - b. _____.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 2. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
 3. Thickness: 0.016 inch sheet.
 4. Finish: Smooth.
 5. Joining: Longitudinal slip joints and 2 inch laps.
 6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
 7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.04 LOW TEMPERATURE FITTING INSULATION:

- A. For piping 1-1/2" and smaller, all valves, strainers, ball valves and balancing valves shall be insulated with standard pipe insulation in the thicknesses listed above.
- B. For piping 2" and larger, all valves, strainers, ball valves and balancing valves shall be insulated with a factory fabricated removable and reusable cover.
- C. Insulation shall have a minimum k- factor .26, using fiberglass blanket (or flexible elastomeric foam insulation if specified above). Flame and smoke spread shall be 25/50 per ASTM E-84.
- D. Outer jacket shall be made of material equal to DuPont Tychem® QC, overlapping and completely covering the insulation with seams joined by tabs made from hook and loop fasteners (Velcro). Butt ends shall have sewn-in-place elastic.
- E. Outer jacket shall overlap adjoining sections of pipe insulation.
- F. Fitting jackets shall be as manufactured by No Sweat Valve Wraps, Inc., or approved equal.

2.05 REFRIGERATION PIPING INSULATION:

- A. All refrigeration suction lines, liquid lines, hot gas lines, and hot gas by-pass lines both inside and outside the building shall be insulated with 3/4" thick flexible elastomeric foam insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. Provide Elastomeric Foam Insulation for all piping concealed in equipment cabinets for fan coils, induction displacement units, and unit heaters. Insulation thickness shall be as noted in schedules below.
- G. Flexible Elastomeric Foam Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 - 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 - 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

- b. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
 - 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of cellular-glass insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange installation application.
- H. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- I. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- J. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- K. Inserts and Shields:
 - 1. All piping 1-1/2" and smaller, no insert is required below the insulation. Saddles shall be provided for all insulated piping. Both inserts and saddles shall be provided for all piping 2" and larger.
 - 2. A pipe insulation protection saddle of 22 gauge galvanized sheet metal for piping 3" diameter and smaller, and 18 gauge for piping larger than 3" diameter, shall be provided at supports where pipe is supported by the insulation or inserts. The saddle shall be at minimum length of 12 inches.
 - 3. Pipe supports for piping which operates below 250°F shall made be high density phenolic foam pipe insulation similar to Tru-Balance 2550FS saddles as manufactured by Buckaroos, Inc. Insulation in saddles shall meet ASTM E-84 ratings for 25 flame and 50 smoke.
 - 4. Insert Material (for piping that operates above 250 degrees F): Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- L. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.
- M. Apply a PVC jacket to all exposed piping below 8' above finished floor in ALL rooms or spaces where occupants or staff can enter.
- N. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. Heating Water Supply and Return and Glycol Heating Supply and Return Systems

1. Supply and Return: Glass Fiber, Rigid.

<u>Service</u>	<u>Pipe Size</u>	<u>Insulation Thickness</u>
105F to 200F	1-1/4 inch and less	1-1/2 inch
	1-1/2 inch and greater	2 inch

- 2. For piping smaller than 1-1/2" and located in partitions within conditioned spaces, reduction of these thicknesses by 1" shall be permitted, but not to a thickness less than 1".

B. Cooling Systems

<u>Service</u>	<u>Pipe Size</u>	<u>Insulation Thickness</u>
Chilled Water	All	1-1/2 inch Rigid Fiberglass with vapor barrier
Chilled Water (Exterior)	All	1 inch (for piping 2-1/2 inch diameter and less), 1-1/2" inch (for piping 3 inch diameter and larger) Polyiso Insulation with Jacket
Refrigeration Suction/Liquid/Hot Gas	All	3/4 inch Flexible Elastomeric Foam
Cooling Coil Condensate	All	3/4 inch Flexible Elastomeric Foam

END OF SECTION

SECTION 23 0784 - MECHANICAL FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all mechanical through and membrane penetrations in fire-resistance rated and smoke-resistant assemblies , whether indicated on drawings or not .

1.02 REFERENCE STANDARDS

- A. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2009.
- B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- C. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.
- D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.
- F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Schedule of Firestopping: List each type of penetration.
 - 2. Product Data: Provide data on product characteristics.
- C. Closeout Documents:
 - 1. Certificate from authority having jurisdiction indicating approval of materials used.

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 the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) 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. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors , or meeting any two of the following requirements:.
 - 2. With minimum 3 years documented experience installing work of this type.
 - 3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
 - 4. Licensed by authority having jurisdiction.

1.05 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
- B. Obtain approval of authority having jurisdiction before proceeding.
- C. If accepted, mock-up will represent minimum standard for the Work.
- D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.06 SCOPE / APPLICATION

- A. Provide installed firestop protects that limit the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in rated assemblies, including walls, partitions, floors, roof/ceilings, and similar locations. restoring the integrity of the fire rated construction to its original fire rating.
- B. Provide firestop systems listed for the specific combination of fire rated construction, type of penetrating item, annular space requirements, and fire rating, and the following criteria:
 - 1. F-Rating: Equal to or greater than the fire-resistance rating of the assembly in which the firestopping will be installed.
 - 2. T-Rating: In habitable areas where penetrating items are exposed to potential contact with materials on fire side(s) of rated assembly, T-rating must equal its F-rating.
 - 3. L-Rating: L-rating of 1 cfm per linear foot (5.5 cu m/h/m) maximum at ambient temperatures.
 - 4. Wall Penetrations: Systems must be symmetrical, with the same rating from both sides of the wall.

1.07 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. 3M Fire Protection Products: www.3m.com/firestop.
- B. Hilti, Inc: www.us.hilti.com.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.

2.03 MATERIALS

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Cast-in-Place Devices: Firestopping device for use prior to a concrete pour. Adjustable height with pull tabs, straight edge design for close placement to walls and adjacent devices.
 - 1. Fire Resistance: For use in 1, 2, or 3 hour fire rated systems.
- C. One piece metal collar assembly encasing intumescent material for firestopping of pipes and cables through rated walls and floors.
 - 1. Fire Resistance: For use in 1 or 2 hour fire rated systems.
- D. Plastic Pipe Device: Intumescent device for firestopping of plastic pipe and cables through rated walls and floors.
 - 1. Configuration: One-piece metal collar, with locking latch and bendable tabs to secure; equipped also for conventional anchoring.
 - 2. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- E. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant;
 - 1. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- F. Foam Firestopping: Single component silicone foam compound;

- G. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers;
- H. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening;
- I. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, intended to be installed after penetrating item has been installed;
- J. Firestop Devices - Cast-In Type: Sleeve and sealing material, intended to be cast in concrete floor forms or in concrete on metal deck, not requiring any additional materials to achieve penetration seal.
 - 1. Durability and Longevity: Permanent.
- K. Intumescent Putty: Compound that expands on exposure to surface heat gain.
 - 1. Fire Resistance: For use in 1, 2 or 3 hour fire rated systems.
- L. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration;;
- M. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- C. Remove incompatible materials that could adversely affect bond.
- D. Install backing materials to arrest liquid material leakage.
- E. Verify that items penetrating fire rated assemblies are securely attached, including sleeves, supports, hangers, and clips.
- F. Verify that openings and adjacent areas are not obstructed by construction that would interfere with installation of firestopping, including ducts, piping, equipment, and other suspended construction.
- G. Install masking and temporary coverings as required to prevent contamination or defacement of adjacent surfaces due to firestopping installation.

3.03 INSTALLATION

- A. Non-rated assemblies shall be draft stopped.
- B. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- C. Install so that openings are completely filled and material is securely adhered.
- D. Where firestopping surface will be exposed to view, finish to a smooth, uniform surface flush with adjacent surfaces.
- E. After installation is complete, remove combustible forming materials and accessories that are not part of the listed system.
- F. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned.

- G. Do not cover firestopping with other construction until approval of authority having jurisdiction has been received.
- H. Do not cover installed firestopping until inspected by authority having jurisdiction.
- I. Install labelling required by code.
- J. Install identification Labels for Through Penetration and Construction Joint Systems: Pressure sensitive self-adhesive vinyl labels, preprinted with the following information:
 - 1. The words "Warning - Through Penetration Firestop System - Do not Disturb. Notify Building Management of Any Damage."
 - 2. Listing agency's system number or designation.
 - 3. System manufacturer's name, address, and phone number.
 - 4. Installer's name, address, and phone number.
 - 5. General contractor's name, address, and phone number (if applicable).
 - 6. Date of installation.

3.04 CLEANING

- A. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned
- B. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

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

END OF SECTION

SECTION 23 0913 - INSTRUMENTS AND CONTROL ELEMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thermostats.
- B. Control panels
- C. Control valves.
- D. Electronic valve actuators
- E. Damper operators.
- F. Temperature sensors
- G. Humidity sensors
- H. Outside air sensors
- I. Duct mounted sensors
- J. Pressure sensors
- K. Differential pressure sensors
- L. Status and safety switches
- M. Variable Frequency Drive

1.02 REFERENCE STANDARDS

- A. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
 - 2. Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system. For variable frequency drives: indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- C. Closeout Documents:
 - 1. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
 - 2. Project Record Documents: Record actual location of control components, including panels, thermostats, and sensors.
 - a. Revise shop drawings to reflect actual installation and operating sequences.
 - 3. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum ten (10) years experience approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle equipment in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. Provide a 120V power transformer and a convenience outlet within the cabinet.
- C. NEMA EN 10250, general purpose utility enclosures with enameled finished face panel.
- D. Provide common keying for all panels.

2.03 CONTROL VALVES

- A. Control valves shall be 2-way or 3-way mixing (or diverting) as indicated in drawings. Pressure drop through water valves shall be 120% of the pressure drop through the controlled equipment with a maximum of 5 psi pressure drop. Pressure drop through medium pressure steam valves with atmospheric returns shall be 80% of inlet steam pressure.
- B. Ball Valves, 1/2 through 2 in.:
 - 1. Ball Valves shall have forged brass bodies. Valves shall have available either Chrome Plated Brass Balls or 300 Series Stainless Steel Balls in all sizes. Valves shall have available either Nickel Plated Brass Stems or 300 Series Stainless Steel Stems with a blow-out proof stem design in all sizes.
 - 2. Valves shall have Graphite reinforced Polytetrafluoroethylene (PTFE) seats with Ethylene Propylene Diene Monomer (EPDM) O-ring backing. Stem seals shall be double EPDM O-rings.
 - 3. Flow Characterization Disk shall be rated for 50 psid maximum differential pressure and shall be inserted against the casting of the valve.
 - 4. All ball valves with internal pipe thread end connections shall be rated to 580 psi maximum static pressure at 203°F fluid temperature. All ball valves with sweat end connections or press end connection shall be rated to 300 psig maximum static pressure at 203°F fluid temperature
 - 5. All valves shall be rated for service with hot water, chilled water and 50% glycol solutions. Ball Valves with stainless steel balls and stems shall be rated for use with 15 psig saturated steam. Valves shall be rated for 200 psid closeoff pressure. Flow Characteristics shall be equal percentage on the control port. Bypass port on three-way valves shall have linear flow characteristics.
- C. Ball Valves, 2-1/2 through 4 in. Flanged:
 - 1. Ball Valves shall have forged brass bodies with ASME Class 150 ductile iron flanges. Valves shall have 300 Series Stainless Steel Balls. Valves shall have 300 Series Stainless Steel Stems with a blow-out proof stem design.

2. Valves shall have Graphite reinforced Polytetrafluoroethylene (PTFE) seats with Ethylene Propylene Diene Monomer (EPDM) O-ring backing. Stem seals shall be double EPDM O-rings.
 3. Flow Characterization Disk shall be rated for 50 psid maximum differential pressure. Flow Characteristics shall be equal percentage on the control port. Bypass port on three-way valves shall have linear flow characteristics.
 4. All valves shall be rated for service with hot water, chilled water, 50% glycol solutions and rated for use with 25 psig saturated steam.
 5. Two-Way Valves shall be rated for 100 psid closeoff pressure and Three-Way Valves shall be rated for 50 psid closeoff pressure.
- D. Butterfly Valves, 2 through 20 in. resilient seat ASME Class 125/150 Flanged:
1. Butterfly Valves shall have cast iron bodies and be fully lugged.
 2. Butterfly Valves seat shall be Ethylene Propylene Diene Monomer (EPDM). Butterfly Valve disk shall be Ductile Iron with Nylon 11 coating. Butterfly Valve stems shall be Stainless Steel. Flow Characteristics shall be equal percentage up to 70° of disk rotation.
 3. All valves shall be rated for service with hot water, chilled water and 50% glycol solutions.
- E. Butterfly Valves, High Performance 2-1/2 through 16 in ASME Class 150 or 300:
1. Butterfly Valves shall have bodies manufactured from Carbon Steel and shall be fully lugged.
 2. Butterfly Valves seat assembly shall be RPTFE (reinforced polytetrafluoroethylene) and the seat retainer shall be Carbon Steel. Butterfly Valve disk shall be Stainless Steel. Butterfly Valve stems shall be 17-4 PH Stainless Steel. Butterfly Valve Stem Seals shall be One Carbon Fiber Ring and Three TFE Rings.
 3. Flow Characteristics shall be equal percentage up to 70° of disk rotation.
 4. All valves shall be rated for service with hot water, chilled water, 50% glycol solutions and 50 psig saturated steam in modulating service or 150 psig saturated steam in two position service.
- F. Globe Valves, Brass, 1/2 through 2 in.
1. Valves shall have bodies manufactured from brass. Valves shall meet the pressure and temperature requirements of ANSI B16.15, Class 250.
 2. Valve stems shall be a 300 Series Stainless Steel. Valves with brass plug and seat shall have stem seals with Self-Adjusting Ethylene Propylene Rubber (EPR) Ring Pack U-Cups. Valves with Stainless Steel plug and seat shall have stem seals with Spring Loaded Polytetrafluoroethylene (PTFE) and Elastomer V-Rings.
 3. Flow Characteristics shall be equal percentage for two-way valves and linear for three-way valves.
- G. Globe Valves, Cast Iron, 2-1/2 through 6 in.
1. Valves shall have bodies manufactured from cast iron. Valves shall meet the pressure and temperature requirements of ANSI B16.1, Class 125.
 2. Valve stems shall be a 316 Series Stainless Steel. Valves shall have stem seals with Ethylene Propylene Terpolymer (EPT) Ring Pack U-Cups
 3. Flow Characteristics shall be equal modified linear.
- H. Temperature control valves shall be located within 24" and in the same room as the piece of equipment that it serves. This includes fin tube, unit heaters, coils, etc. Any deviation from this must be cleared with the contracting officer.

2.04 ELECTRONIC VALVE ACTUATORS

- A. Select actuator for full shutoff at maximum pump differential pressure or for maximum torque required for proper damper close off. Actuators shall be either two position or modulating based on the sequence of operations.

1. Two position actuators shall be provided with synchronous motor with enclosed gear train, dual-return springs, and valve-position indicator. Actuators shall fail to last position. Two position control valves shall be low pressure drop type valves.
 2. Modulating actuators shall be self-contained, linear motor, actuator with 60-second full travel, with transformer and single-throw, double-pole contacts. Actuators shall fail as noted below.
- B. Valve actuators shall be UL-recognized or CSA-certified. Provide valve actuators as noted in the following:
1. Provide spring return normally open actuators on air handling unit heating valves.
 2. Provide spring return normally closed actuators on chilled water valves.
 3. Actuators serving steam valves, radiation valves, and terminal devices shall fail to last position.

2.05 DAMPER OPERATORS

- A. General:
1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
 2. Provide spring return for two position control and for fail safe operation.
 3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
 4. Provide one operator for maximum 36 sq ft damper section.
 5. See Section 25 3513 for field-mount damper actuators and operators.
- B. Actuators shall be direct-coupled design requiring no crank arm or linkage for mounting to a shaft. Provide a means of overload protection at all angles of rotation that does not require the use of end switches. Provide with a NEMA rated enclosure appropriate for the installation. Actuator shall be sized for the torque required to seal damper at load conditions. Actuators shall be rated for the environment in which they will be installed. Proportional actuators shall be user configurable without the use of external computer software or programming tools. Calibration, input signal range selection, and control logic reversal shall be selectable with an external mode selection switch. Provide end switches where indicated on the sequence of operations.
- C. Spring Return Actuators:
1. Coupling: toothed V-bolt clamp and nuts with toothed cradle.
 2. Reversible Mounting: Provides either clockwise or counterclockwise operation.
 3. Power Failure Operation: Mechanical spring return system drives load to the home position.
 4. Motor Technology shall be either modulating or on/off based on the sequence of operations. Modulating types shall be microprocessor-controlled brushless DC motor. On/Off types shall be DC brush motor.
- D. Non-Spring Return Actuators:
1. Couplings above 80 lb.-in. shall be toothed V-bolt clamp and nuts with toothed cradled. Couplings 80 lb.-in. and below shall be single cup-point set screw and toothed cradle.
 2. Parallel Operation: Actuators shall be available that are capable of being mechanically or electrically paralleled.
- E. Provide normally closed (spring return) actuators at Outside Air, Relief Air, and Exhaust Air damper locations unless otherwise indicated.

2.06 TEMPERATURE SENSORS

- A. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
- B. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, two-wire 1000 ohm platinum RTD, or 20 kohm NTC.

- C. Chilled water, room temperature, and duct temperature shall be ± 0.5 deg. F accuracy. All other temperature point types shall be ± 0.75 deg. F accuracy.
- D. Room Temperature Sensors:
 - 1. Room sensors shall be constructed for either surface or wall box mounting.
 - 2. Room sensors in all public/transitory spaces including corridors, vestibules, receptions areas, restrooms, etc. shall be flat plate sensor only type with no local control/adjustment capabilities.
 - 3. Room sensors in offices, classrooms, or other private/staff controlled spaces shall have an integral LCD display with the following capabilities:
 - a. Display room air temperatures.
 - b. Display and adjust room comfort set point.
 - c. Timed override request push button with LED status for activation of after-hours operation.
 - d. Display controller mode.
 - e. Password selectable adjustment of set point and override modes.

2.07 HUMIDITY SENSORS

- A. The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
- B. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
- C. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
- D. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R (IP54) or NEMA 4 (IP65) enclosure with sealite fittings.
- E. A single point humidity calibrator shall be provided for field calibration. Transmitters shall be shipped factory pre-calibrated.
- F. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

2.08 OUTSIDE AIR SENSORS

- A. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element. Temperature transmitters shall be of NEMA 3R (IP54) or NEMA 4 (IP65) construction and rated for ambient temperatures. The outdoor sensor can be easily mounted on a roof, pole or side of a building utilizing its already assembled mounting bracket. Outside Relative Humidity sensors 0-100% full range of accurate measurement; operating temperature -4 to 140F. Outside temperature sensors operating temperature range is -40 to 140F, ± 0.55 F.

2.09 DUCT MOUNT SENSORS

- A. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
- B. Provide an averaging sensor with multiple sensing points in ductwork greater in any dimension than 48 inches, where air temperature stratification exists, and in air handling unit cabinets. For plenum applications, such as mixed air temperature measurements, a continuous averaging sensor or a string of sensors mounted across the plenum shall be used to account for

stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment. Capillary supports at the sides of the duct shall be provided to support the sensing string.

2.10 PRESSURE SENSORS

- A. Verify range of water pressure sensors such that full pumping head will not exceed maximum over-pressure limit.
- B. Water pressure sensors shall be differential type with pressure sensing diaphragm housed in a stainless steel body. The body shall have two ¼ inch FNPT pressure connections. Pressure range shall be 0 to 25 or 0 to 50 psi based on the system requirements. The sensor shall allow a 200% of full scale over-pressure without damage or permanent offset. The output signal shall be 0-10 VDC or 4-20 mA and linear with applied pressure and shall have a field adjustable offset and span. Input power shall be 24 VAC or 24 VDC. Accuracy shall be +/- 0.25% of full scale range. Provide tee with valves and pressure gauge across switch for visual verification of differential.
- C. Verify range of static pressure sensors. Velocity pressures of 1 inch w.c. corresponds to duct velocity 4000 fpm.
- D. Air static pressure and velocity pressure sensors shall be differential type with pressure sensing diaphragm housed in a brass body. The body shall have two 3/16 inch barbed fittings suitable for connection by ¼ inch pneumatic tubing. Pressure range shall be 0 to 5 in. w.c. for static pressure sensing and 0 to 1 inch w.c. for velocity pressure sensing. The sensor shall allow a 200% of full scale over-pressure without damage or permanent offset. The output signal shall be 0-10 VDC or 4-20 mA and linear with applied pressure and shall have a field adjustable offset and span. Input power shall be 24 VAC or 24 VDC. Accuracy shall be +/- 1% of full scale.

2.11 DIFFERENTIAL PRESSURE SENSORS

- A. General Air and Water Pressure Transmitter Requirements:
 - 1. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - 2. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - 3. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
 - 4. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
- B. Low Differential Water Pressure Applications (0" - 20" w.c.)
 - 1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications. Sensor shall maintain accuracy up to 20:1 ratio turn down with a reference accuracy of +0.2% of full span.
- C. Medium to High Differential Water Pressure Applications (Up to 300 psi.)
 - 1. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions. The sensor shall be capable of accurately measuring differential pressure up to 300 psi with a reference accuracy of +1% of full span.
 - 2. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in

the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

- D. Building Differential Air Pressure Applications (-1" to +1" w.c.)
 - 1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications. Sensor shall maintain accuracy up to 20:1 ratio turn down with a reference accuracy of +0.2% of full span. Select the appropriate pressure range for each sensor in each application.
- E. Differential Air Pressure Applications (0" to 5" w.c.)
 - 1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications. Sensor shall maintain accuracy up to 20:1 ratio turn down with a reference accuracy of +0.25% or 0.5% of full span. Select the appropriate pressure range for each sensor in each application.

2.12 STATUS AND SAFETY SWITCHES

- A. General Requirements - Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.
- B. Current Sensing Switches - The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
- C. Air Filter Status Switches - Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters. Provide appropriate scale range and differential adjustment for intended service.
- D. Air Flow Switches - Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
- E. Air Pressure Safety Switches - Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
- F. Low Temperature Limit Switches - The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

2.13 VARIABLE FREQUENCY DRIVE

- A. Provide enclosed variable frequency drive suitable for operating the indicated loads. Where the load is less than 5 HP, provide a drive with capability of a future load of 5 HP. Conform to requirements of NEMA ICS 3.1. Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. Conform to requirements of NFPA 70. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.
- B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- C. Product Data: Provide catalog sheets showing voltage, drive size, ratings and size of switching and over-current protective devices, short circuit ratings, dimensions, and enclosure details.
- D. Test Reports: Indicate field test and inspection procedures and test results.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- F. Manufacturer's Field Reports: Include instructions for starting and operating drives, and describe operating limits that may result in hazardous or unsafe conditions. Indicate start-up inspection findings.
- G. Maintenance Data: Include routine preventive maintenance schedule.
- H. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- I. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.
- J. Furnish service and maintenance of drive for one year from Date of Substantial Completion.
- K. Heat rejection from the drive shall be done through an external heat sink. Drives that pass air over the electronic components shall not be allowed.
- L. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding. Prepare and start systems. Make final adjustments to installed drive to assure proper operation of the systems. Demonstrate operation of drives in automatic and manual modes.
- M. Drive Design:
 - 1. Rated Input Voltage shall be as described on the equipment schedule(s).
 - 2. Operating Ambient: 32 degrees F to 104 degrees F. continuously.
 - 3. Design for ability to operate drive with motor disconnected from output WITHOUT utilizing any interlock or safe.
 - 4. Design to attempt five (adjustable) automatic restarts following fault condition before locking out and requiring manual restart.
 - 5. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.
 - 6. Status Indicators: Separate indicators for over-current, over-voltage, ground fault, over-temperature, and input power ON.
 - 7. Protection: AC Input Over-voltage, AC Input Under-voltage, Bus Over-voltage, Bus Under-voltage
 - 8. Capable of setting three lockout frequencies minimum.
 - 9. Volts per Hertz Adjustment: Plus or minus 10 percent.
 - 10. Current Limit Adjustment: 60 - 110 percent of rated.
 - 11. Acceleration Rate Adjustment: 0.5 - 30 seconds.
 - 12. Deceleration Rate Adjustment: 1 - 30 seconds.

13. Provide HAND-OFF-AUTOMATIC selector switch and manual speed control.
 14. Input Signal: Drive shall be capable of both 4-20 mA DC and 0-10 Volts DC-
 15. Form C Output Contacts: Drive Fault and Drive Alarm.
 16. One Form A programmable output.
 17. One Form A Run contact.
 18. Provide RS485 (contractor to verify) serial bus communications module compatible with building automation system. Provide all software, drivers, programming and documentation as required by building automation system.
 19. Safety Interlocks: Provide terminals for remote contact to inhibit starting under both manual and automatic mode.
 20. Control Interlocks: Provide terminals for remote contact to allow starting in automatic mode.
 21. Disconnecting Means: Include integral fused disconnect switch on the line side of the drive.
 22. Input Line Reactance: Provide a minimum of 5% impedance on the input to the drive. If the standard drive design does not meet the specification of 5%, additional inductors shall be provided to bring the drive up to the specified level.
 23. Line reactors when required shall be furnished and installed by the drive manufacturer. Reactors shall be mounted in the enclosure where possible. If mounted exterior of enclosure, installation shall be provided by the drive supplier.
 24. Enclosure: NEMA Standard 250, Type 1, 3R, 4, or 12 based on NEC requirements for the enclosure's location.
 25. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- N. The drive shall be capable of providing the following features.
1. 4 PID controllers for use of controlling the motor speed and up to 3 other functions.
 2. Contain a USB port for ease of programming, troubleshooting and trend logging through a standard laptop computer. The software for the communication shall be free and online.
 3. Automatic Motor Adaptation to provide tuning of the drive to the motor to optimize performance and efficiency.
 4. Automatic Energy Optimization adjusts the output voltage to match the real torque requirement to save energy.
 5. Drives serving cooling towers shall be provided with built in motor pre-heater to keep the motor warm and dry.
 6. Broken belt protection to fault the drive and signal the automation in loss of flow due to a broken belt or closed valve.
 7. Auto ramping eliminates tripping due to acceleration or deceleration.
 8. Flying start to match the motor speed of a spinning fan at time of start or restart.
 9. ENGLISH language display of all functions and faults the use of codes and numbers shall not be allowed.
 10. Quick setup menu to provide Easy and Quick start up and commissioning.
 11. Personal Menu for access by an operator to change only the items needed without hunting through the entire programming format.
 12. Keypad shall be password protected at two levels to prevent inadvertent changes by unauthorized personnel.
 13. STANDARD on board RFI/EMI filter.
- O. Manufacturers shall be ABB, Mitsubishi, Allen Bradley, Reliance, Danfoss, Square D, Siemens, Honeywell, Trane TR200 or Johnson Controls.

2.14 THERMOSTATS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.
- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- H. Verify that surface is suitable for controller installation.
- I. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount thermostats or temperature sensors on interior walls.
 - 1. If thermostats or sensors must be mounted on exterior wall, provide insulated sub-base.
- C. Mount freeze protection thermostats using flanges and element holders.
- D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- E. Provide separable sockets for liquids and flanges for air bulb elements.
- F. Provide guards on thermostats in entrances.
- G. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- H. Provide separate steam valves for each bank of coils. Provide two valves in parallel where steam load exceeds 1,500 lb/hr with 1/3 to 2/3 load capacities sequenced with smaller valve opening first.
- I. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- J. Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- K. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- L. Identify variable frequency controllers in accordance with Section 26 0553.
- M. Install hazardous gas monitoring equipment including sensors, audible alarms, as shown on Contract Drawings, and as recommended by manufacturer of equipment, and as required by authorities having jurisdiction. Install conduit and wiring from sensors to control panel and to the fan starters/ HVAC control panel as recommended by manufacturer of equipment.

3.03 FIELD QUALITY CONTROL

- A. Provide the service of the manufacturer's field representative to prepare and start VFD controllers.
- B. Perform field inspection and testing in accordance with Section 01 4000.
- C. Inspect and test in accordance with NETA STD ATS, except Section 4.
- D. Perform inspections and tests listed in NETA STD ATS, Section 7.17.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate operation of VFD controllers in automatic and manual modes.

3.05 MAINTENANCE

- A. Provide service and maintenance of control system for one year from Date of Substantial Completion.
- B. Provide complete service of controls systems, including call backs, and submit written report of each service call.
- C. In addition to normal service calls, make minimum of seasonal complete normal inspections of approximately four hours duration to inspect, calibrate, and adjust controls.

SECTION 23 0923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System description.
- B. Operator interface.
- C. Web browser interface.
- D. Controllers.
- E. Power supplies and line filtering.
- F. BACNET capabilities.
- G. System software.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).
- B. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h, with Editorial Revision (2022).
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. The Automatic Temperature Controls Contractor shall coordinate with the project Balancing Contractor & Chemical Treatment Contractor for control software access necessary to facilitate the balancing & flushing processes. The Automatic Temperature Controls Contractor shall allow full building system software access to the project balancing contractor during construction and project commissioning as necessary. The Automatic Temperature Controls Contractor shall provide an override button available to the Balancing and Chemical Treatment Contractor that will drive open all control valves for the purpose of flushing & balancing the hydronic system(s). All water coils shall be opened to the system prior to the air system start-up to ensure proper mixing of glycol throughout the piping system. The Automatic Temperature Controls Contractor shall provide up to 12 hours of assistance for navigation and use of software as required.

1.04 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data and Shop Drawings: Contractor shall provide shop drawings or other submittals on all hardware, software, and installation to be provided. No work may begin on any segment of this project until submittals have been reviewed and approved for conformity with the design intent. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include:
 - 2. Direct Digital Control System Hardware:
 - a. A complete bill of materials of equipment to be used shall be listed indicating quantity, manufacturer, model number, and other relevant technical data.
 - b. Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions shall be included for all

relevant items including but not limited to: direct digital controller and all controller panels; transducers/transmitters; sensors including accuracy data; actuators; valves; relays/switches; control panels; power supply; batteries; operator workstation equipment; wiring; wiring diagrams and layouts for each control panel; Schematic diagrams for all field sensors and controllers with floor plans of all sensor locations and control hardware.

3. Central System Hardware and Software
 - a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and other relevant technical data.
 - b. Manufacturer's description and technical data, such as product specification sheets and installation/maintenance instructions shall be included for all relevant items including but not limited to: central processing unit (CPU); monitors; keyboard; uninterruptible power supply; interface equipment between CPU and control panels; operating system software; operator workstation software; color graphic software; and third-party software.
 - c. A schematic diagram for all control wiring, communication wiring and power wiring shall be provided. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers, function and data link protocol(s). Show all interface wiring to the control system.
 - d. Provide detailed riser diagrams of wiring between central control unit, operator workstation(s), routers, gateways and all control panels.
 - e. A list of the color graphic screens shall be provided. For each screen, provide a conceptual layout of pictures and data, and show or explain which other screens can be directly accessed.
4. Controlled Systems:
 - a. A schematic diagram of each controlled system. The schematics shall have all control points/objects labeled and with point/object names shown or listed. The schematics shall graphically show the location of all control elements in the system.
 - b. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled
 - c. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
 - d. A mounting, wiring, and routing plan view drawing. The drawing shall be done in 1/4" scale. The design shall take into account HVAC, electrical and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work
 - e. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
 - f. A point/object list for each system controller including inputs and outputs (I/O), point/object number, the controlled device associated with the I/O point/object, and the location of the I/O device. Software flag points/objects, alarm points/objects, etc.

C. Closeout Documents:

1. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owners name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- D. Direct digital control panels shall comply with Federal Communications Commission (FCC) Regulation, Part 15, Subpart J, for Class A computing devices.
- E. All wiring shall be in accordance with the current National Electrical Code and all local electrical codes.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a two year period after Substantial Completion.
- C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Johnson Controls, Inc. - Metasys (Fargo Branch Office)

2.02 SYSTEM DESCRIPTION

- A. An existing DDC building automation system manufactured by Automated Logic is currently in the building. The system shall be expanded to accommodate the new work under this project including but not limited to:
 - 1. Expand the existing network to accommodate the additional points and communication.
 - 2. Upgrade the existing controls system to current versions. Upgrade all existing unit controllers to provide one unified control system (one point of access).
 - 3. Upgrade and add graphics for additional control points, integrating both existing graphics and new graphics into a unified interface.
 - 4. Provide additional processing power and memory for additional points.
- B. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- C. 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.
- D. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- E. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.
- F. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- G. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 WEB BROWSER INTERFACE

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine

requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BAS, shall not be acceptable. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

- B. The Web browser client shall support user log-on identification and password. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
- C. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format. Storage of the graphical screens shall be in the Server, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client PC are not acceptable.
- D. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
- E. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to modify common application objects, such as schedules, calendars, and set points in a graphical manner. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
- F. No entry of text shall be required for Commands to start and stop binary objects.
- G. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
- H. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.04 CONTROLLERS

A. SUPERVISORY NETWORK CONTROLLERS:

- 1. Supervisory network controllers shall be used to manage and schedule global control strategies on the network and communicate with the local Operator's Workstation. A minimum of one (1) supervisory network controller shall be used for the direct digital control system. Each supervisory network controller shall include its own microprocessor, program and data memory, power supply, network communications module, and battery. Supervisory network controllers may also include input/output modules and shall be capable of sharing its point and data information with other controllers on the network.

B. EQUIPMENT CONTROLLERS:

- 1. Equipment controllers shall be used to control all large HVAC equipment such as air handling units, central heating plant equipment, central cooling plant equipment, etc. A minimum of one (1) equipment controller shall be used for each air handling unit.
- 2. Each equipment controller shall include its own microprocessor, program and data memory, power supply, input/output modules, and battery. All program and data memory shall be read/write random access memory (RAM) type with battery backup. The battery shall be self-charging and capable of supporting all memory within the controller for a minimum of seventy-two (72) hours if commercial power to the unit is interrupted. Upon the resumption of normal power, the runtime control software shall analyze the status of

- all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.
3. Each equipment controller shall be capable of sharing point and data information with other controllers, such that control sequences or control loops executing in one controller may receive input signals from sensors connected to other controllers on the network. If the network communication link fails or the originating controller malfunctions, the control loop shall continue to function using the last value received from the failed controller. Failure of one controller shall have no other effect upon any of the other controllers in the network.
 4. This contractor shall provide a NEMA 1 enclosure for any controllers furnished.
 5. Terminal unit controllers shall be used to control all small HVAC terminal unit equipment such as variable air volume boxes, dual duct boxes, heat pumps, fan coil units, unit ventilators, terminal coils, etc. A minimum of one (1) terminal unit controller shall be used for each terminal unit.
- C. TERMINAL UNIT CONTROLLERS:
1. Terminal unit controllers shall be used to control all small HVAC terminal unit equipment such as variable air volume boxes, dual duct boxes, heat pumps, fan coil units, unit ventilators, terminal coils, etc. A minimum of one (1) terminal unit controller shall be used for each terminal unit.
 2. This contractor shall provide a NEMA 1 enclosure for any controllers furnished.
 3. Each terminal unit controller shall include its own microprocessor, program and data memory, power supply, input/output modules, and battery. All program and data memory shall be read/write random access memory (RAM) type with non-volatile memory similar to EEPROM (Electrically Erasable Programmable Read-Only memory). Upon the resumption of normal power, the runtime control software shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.
 4. Each terminal unit controller shall be capable of sharing point and data information with other controllers, such that control sequences or control loops executing in one controller may receive input signals from sensors connected to other controllers on the network. If the network communication link fails or the originating controller malfunctions, the control loop shall continue to function using the last value received from the failed controller. Failure of one controller shall have no other effect upon any of the other controllers in the network.

2.05 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies:
1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
 2. Limit connected loads to 80 percent of rated capacity.
 3. Match DC power supply to current output and voltage requirements.
 4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
 5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
 6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
 7. Operational Ambient Conditions: 32 to 120 degrees F.
 8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
 9. Line voltage units UL recognized and CSA approved.
- B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:
 - a. Dielectric strength of 1000 volts minimum.
 - b. Response time of 10 nanoseconds or less.
 - c. Transverse mode noise attenuation of 65 dB or greater.
 - d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.06 BACNET CAPABILITIES

- A. BACnet Interoperability Building Blocks (BIBBS) for each DDC system component (network or system level controller) proposed. BACnet is not required for unitary or equipment controllers.
- B. Communication shall be through a translator/gateway that maintains the BACnet protocol.
- C. The unitary or equipment controller supplier shall provide a list confirming their support for all mandatory data, and identifying which optional network variables and configuration properties they support.
- D. Certification shall be verified through the BIBBS statement for the BACnet Certification Authority.
- E. BACnet shall communicate over an Ethernet connection at the system level and conform to ASHRAE Std 135.
- F. Contractor shall map all available Bacnet points for each applicable piece of equipment at discretion of project engineer and owner.

2.07 SYSTEM SOFTWARE

- A. All necessary runtime control software to form a complete operating system as described in this specification shall be provided. The software programs specified in this section shall be provided as an integral part of the direct digital controllers and shall not be dependent upon any higher level computer for execution.
- B. The runtime control software in the equipment controllers and terminal unit controllers shall have the ability to perform the following pre-tested control algorithms and control functions:
 1. Control Loops (two-position, proportional, PI, PID)
 2. Outdoor Air Reset Control
 3. Minimum On/Off Times
 4. Random Start Delay
 5. Night Setback/Setup Control
 6. Simultaneous Heating/Cooling Lockout
 7. Point History Collection
 8. Alarm Reporting
 9. Change of Value Reporting
- C. Point History Collection shall provide a record of value of analog I/O points over the last 72 hours, at 30-minute intervals, and a record of the last 50 status changes for binary type points with the capability of archiving data after that.
- D. Runtime control software in the supervisory network controllers shall have the ability to perform any or all of the following system and energy management routines:
 1. Time of Day, Calendar Based, and Holiday Scheduling
 2. Trending
 3. Optimum Start and Stop
 4. Peak Demand Limiting
 5. Chiller Plant Optimization

- E. All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operation.
- F. Custom Process Programming Capability: Runtime control software shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.
- C. Provide required line voltage wiring including breakers, conductors, conduit, transformers, disconnects and all required accessories to support control systems.
- D. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
- E. Controllers shall be mounted in NEMA 1 enclosures near the equipment served. If multiple controllers are installed in a single enclosure, the controller shall be noted as to the location and equipment served along with a tag on the controlled equipment as to the location of the controller if not within the same room.
- F. VFD's shall be mounted by this contractor. Line voltage to and from the VFD will be by others. Locate VFD's with disconnects in location as shown on plan or within visual sight of the motor in which the VFD serves.
- G. Install software in direct digital control panels and Operator's Workstation. Implement all features of programs to specified requirements and appropriate to sequence of operation.
- H. Connect and configure equipment and software to achieve the sequence of operation specified.
- I. Verify location of room sensors, thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate 48 inches above floor.
- J. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- K. Install damper motors on outside of duct in warm areas, not where exposed to outdoor temperatures.
- L. Install labels and nameplates to identify control components including the following:
 - 1. Control cabinet nameplates
 - 2. Control valve tags
 - 3. Control damper labels
 - 4. Sensor tags

3.03 CONNECTION TO OWNER'S DATA SYSTEM

- A. This contractor shall be responsible for the installation of all data wiring, conduit, terminations, etc., to connect the temperature controls system into the owner's data network. This contractor shall coordinate the location of the data system connection point, network protocols, and network address with the owner's IT personnel before starting work.

- B. If multiple data connections are required (i.e., multiple ATC panel locations), the ATC contractor shall be responsible for each of the connections necessary.
- C. All costs associated with the installation of the required data connections shall be borne by this contractor.

3.04 BACNET CONNECTIONS TO OTHER EQUIPMENT

- A. This contractor shall coordinate the BACnet protocol and all wiring between the temperature control system and furnished equipment manufacturer.
- B. This contractor shall coordinate the connection protocol (MS/TP or IP) with the equipment manufacturer and/or supplier.
- C. This contractor shall be responsible for the installation of all data wiring, conduit, terminations, etc., to connect the temperature controls system into equipment control panel. This contractor shall coordinate the location of the data system connection point, network protocols, and network address before starting work.
- D. All costs associated with the installation of the required data connections shall be borne by this contractor.

3.05 ELECTRICAL WIRING AND CONNECTIONS

- A. Installation of raceways, boxes, cabinets, wire and cable shall meet or exceed NEC, latest edition.
- B. All cabling in mechanical rooms, down walls to thermostat boxes, and any exposed areas (i.e. gymnasiums, auditoriums, etc) shall be housed in conduit. Areas above concealed ceiling spaces without conduit on the cabling shall have wiring supported from structure above, Wire will not be allowed to lay free on the ceiling/space.
- C. Provide electrical conduit seals to close off openings into the electrical boxes behind any thermostat or sensor. This shall include sealing the conduit after wiring installation. Contractor shall evaluate each box location and insulate the inside of the box if necessary.
- D. All conduit installed as part of the temperature controls system shall be coordinated with owner .
- E. Control wiring when installed above the ceiling shall be furnished with a plenum rated jacket. Wiring may be placed in cable tray where available.
- F. Fasten flexible conductors, bridging cabinets and doors, neatly along hinge side; protect against abrasion. Tie and support conductors neatly.
- G. Number-code or color-code conductors except local individual room controls, for future identification and servicing of control system.
- H. Connect electrical components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
- I. Connect manual reset limit controls independent of manual control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- J. Connect HAND-OFF-AUTO selector switches to override automatic interlock controls when switch is in HAND position.

3.06 MANUFACTURER'S FIELD SERVICES

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
- B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

- C. Provide basic operator training for four persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Included in the total training time listed below, 4-8 hours shall be dedicated to mapping and displaying Bacnet points for all applicable equipment in coordination with the owner. Include a minimum of 20 hours dedicated instructor time. Provide training on site.

3.07 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner.
- B. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
- C. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- D. Provide operator training on data display, alarm and status descriptors, requesting data, execution of commands, and request of logs. Schedule training with Owner with at least 7 days' notice.

3.08 MAINTENANCE

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.
- C. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.
- D. Provide complete service of systems, including call backs. Make minimum of four complete normal inspections of approximately two hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

3.09 COMMISSIONING

- A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to start control systems.
- B. Test and adjust controls and safeties. Recalibrate all sensors where wiring lengths effect sensor readings.
- C. Replace damaged or malfunctioning controls and equipment.
- D. Start, test, and adjust control systems.
- E. Demonstrate compliance with requirements.
- F. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

END OF SECTION

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water piping, above grade.
- C. Chilled water piping, above grade.
- D. Equipment drains and overflows.
- E. Pipe hangers and supports.
- F. Unions, flanges, mechanical couplings, and dielectric connections.

1.02 REFERENCE STANDARDS

- A. 24 CFR 51 - Department of Housing and Urban Development Environmental Criteria and Standards; current edition.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- E. ASME B31.9 - Building Services Piping; 2020.
- F. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- H. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
- K. ASTM B32 - Standard Specification for Solder Metal; 2020.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
- N. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
- O. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018, with Editorial Revision (2024).
- P. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2025a.
- Q. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.
- R. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2020.
- S. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).
- T. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

- U. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
- V. AWS D10.12M/D10.12 - Guide for Welding Mild Steel Pipe; 2000.
- W. AWWA C606 - Grooved and Shouldered Joints; 2015.
- X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.
- Y. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; 2012.

1.03 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturers catalog information.
 - 3. Indicate valve data and ratings.
- D. Closeout Documents:
 - 1. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
 - 2. Project Record Documents: Record actual locations of valves.
 - 3. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum five years of experience.
- C. ALL GROOVED JOINT COUPLINGS, FITTINGS, VALVES, AND SPECIALTIES ARE SPECIFICALLY PROHIBITED.
- D. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
 - 1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.05 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.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Grooved mechanical joints may be used in indoor, accessible locations only.
 - a. Accessible locations include those exposed on interior of building, above lay-in-tile ceilings, in mechanical rooms, and as approved by Engineer.
 - b. Grooved mechanical connections and joints comply with AWWA C606.
 - 1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
 - c. Use rigid joints unless otherwise indicated.
 - d. Depending on pipe size, three or four flexible joints may be used in lieu of a flexible connector. Consult with coupling manufacturer's installation instructions.
 - e. Use gaskets of molded synthetic rubber with central cavity, pressure responsive configuration and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
 - f. Provide steel coupling nuts and bolts complying with ASTM A183.
 - g. Provide rigid couplings with shift limiting slant pad.
 3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
- D. Valves: Provide valves where indicated:
 1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
 2. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
 3. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.
- E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 HEATING WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
 2. Copper press fittings shall be double pressed type and conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM.
 - a. All O-rings shall be rated for 50% ethylene or propylene glycol with 210 degree water.
 - b. Press fit installation shall be in accordance with the manufacturer's specifications contained in latest published literature.
 - c. All press fit couplings, fittings and specialties shall be the products of a single manufacturer.
 - d. Manufacturers:
 - 1) Viega
 - 2) Milwaukee
 - 3) Apollo
 - 4) Nibco

2.03 CHILLED WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
 - 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
 - 2. Threaded Joints: ASME B16.3, malleable iron fittings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) or Type L (B), hard drawn; using one of the following joint types:
 - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22, solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
 - 2. Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. All O-rings shall be rated for 50% ethylene or propylene glycol with 210 degree water. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
 - a. Press fit installation shall be in accordance with the manufacturer's specifications contained in latest published literature.
 - b. All press fit couplings, fittings and specialties shall be the products of a single manufacturer.
 - c. Manufacturers:
 - 1) Viega
 - 2) Milwaukee
 - 3) Apollo
 - 4) Nibco

2.04 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tube: ASTM B88 (ASTM B88M), Type M, drawn; using one of the following joint types:
 - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - 2. Copper press fittings shall be double pressed type and conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.
 - a. All O-rings shall be rated for 50% ethylene or propylene glycol with 210 degree water.
 - b. Press fit installation shall be in accordance with the manufacturer's specifications contained in latest published literature.
 - c. All press fit couplings, fittings and specialties shall be the products of a single manufacturer.
 - d. Manufacturers:
 - 1) Viega
 - 2) Milwaukee
 - 3) Apollo
 - 4) Nibco
- B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
 - 1. Fittings: ASTM D2466 or D2467, PVC.
 - 2. Joints: Solvent welded in accordance with ASTM D2855.

2.05 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58 and MSS SP-69.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 or MSS SP-69 recommendations, which ever is more stringent.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Greater: 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 Greater: 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 Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches and Greater: 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 to 4 Inches: 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 Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated for uninsulated copper pipe.
16. Hanger Rods: Zinc-plated steel, threaded both ends, threaded one end, or continuous threaded.
17. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
18. Hangers and strut located in corrosive areas shall be type 316 stainless steel with stainless steel hardware.
19. Hangers for all piping shall be oversized to encircle the piping and the insulation, the insulation shall be continuous through all hangers.

2.06 UNIONS, FLANGES, AND MECHANICAL COUPLINGS

- A. Unions for Pipe of 2 Inches and Less:
 1. Ferrous Piping: 150 psi brass or malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe 2 Inches and Greater:
 1. Ferrous Piping: 150 psig forged steel, slip-on.
 2. Copper Piping: Bronze.
 3. Gaskets: 1/16 inch thick, preformed neoprene.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment using jointing system specified.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

- E. After completion, fill, clean, and treat systems. See Section 23 2500 for additional requirements.

3.02 INSTALLATION

- A. Welding of piping:
 - 1. The Contractor shall be responsible for welding quality and shall conduct tests of the welding procedures used in the work, determine the suitability of the procedures used, determine that the welds made will meet the required tests, and determine that the welding operators have the ability to make sound welds under standard conditions. All welding shall comply with ASME B31.9.
 - 2. Qualification of Welders: Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform with the applicable portions of ASME B31.9.
The Contractor shall examine each welder to determine the ability of the welder to meet the required qualifications. Welders shall be tested for welds in all positions, including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall weld only in positions in which they have qualified and identify welds with the specific code marking signifying name and number assigned. The Contractor shall furnish a list of welder's names and corresponding code markings. Welders which fail to meet the prescribed welding qualifications shall be retested. Welders who fail the second test shall be disqualified for work on this project.
- B. Install in accordance with manufacturer's instructions.
- C. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.
- D. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- E. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- F. Install piping to conserve building space and to avoid interference with use of space.
- G. Group piping whenever practical at common elevations.
- H. Install firestopping to preserve fire resistance rating of partitions and other elements.
- I. Slope piping and arrange to drain at low points.
- J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
 - 2. Use flexible couplings in expansion loops.
- K. Grooved Joints:
 - 1. Install in accordance with the manufacturer's latest published installation instructions.
 - 2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
- L. Polypropylene Piping:
 - 1. All installation of polypropylene piping shall be conducted by a factory trained installer.
 - 2. The contractor shall coordinate and solicit a factory representative to conduct two (2) site inspections during the installation phase of construction. The contractor shall correct any issues discovered during the inspection at no additional cost to the owner.
- M. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- N. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

2. Support horizontal piping as scheduled.
 3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 4. Place hangers within 12 inches of each horizontal elbow.
 5. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 8. Provide copper plated hangers and supports for copper piping.
 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- O. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- P. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- Q. Use eccentric reducers to maintain top of pipe level.
- R. Seal exterior wall penetrations above grade weather tight.
- S. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.
- T. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- U. Install valves with stems upright or horizontal, not inverted.

3.03 TESTING

- A. Hydronic Piping shall be tested hydrostatically in accordance with latest edition of ASTM B31.9 and the following:
1. Other than ground source heat pump loop systems:
 - a. Pressure: 1-1/2 times working pressure but not less than 100 psi.
 - b. Duration: 15 minutes
 2. PEX piping systems, testing may be with compressed gas as an alternative to hydrostatic where compressed air when specifically authorized by the manufacturer's instructions for PEX piping and all fittings installed.

3.04 SCHEDULES

- A. Space hangers so as to prevent sag and permit proper drainage. A hanger shall be placed within one foot of each horizontal elbow.
- B. Hanger spacing to comply with all local code requirements.

END OF SECTION

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strainers.
- B. Pressure-temperature test plugs.
- C. Balancing valves and Flow meters.

1.02 REFERENCE STANDARDS

- A. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2025).

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
 - a. Include applicable performance data for each specific device (flow rate, pressure drop, etc.).
 - 2. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.
- C. Closeout Documents:
 - 1. Project Record Documents: Record actual locations of flow controls.
 - 2. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.
 - 3. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements for additional provisions.

1.04 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.

PART 2 PRODUCTS

2.01 STRAINERS

- A. Manufacturers:
 - 1. Gustin-Bacon
 - 2. Titan
 - 3. Anvil
 - 4. Keckley
 - 5. MetraFlex.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Size 2 inch and Under:
 - 1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
- C. Size 2-1/2 inch to 4 inch:
 - 1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.02 PRESSURE-TEMPERATURE TEST PLUGS

- A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- B. Application: Use extended length plugs to clear insulated piping.

2.03 HOSE KITS AND VALVES

- A. Manufacturers:
 - 1. Bell & Gossett
 - 2. Griswold Controls
 - 3. Hays Fluid Controls
 - 4. IMI Flow Design
 - 5. Nexus
 - 6. Victaulic
 - 7. Nibco
- B. Hoses:
 - 1. Provide hoses for all units for connection to main water supply and return headers.
 - 2. Length: 2 feet.
 - 3. Material: Braided stainless steel rated to minimum 400 psi at 265 degrees F.
- C. Manual Balancing Valves:
 - 1. Brass or bronze body shutoff and hydronic balancing.
 - 2. Balancing Valves to comply with "Balancing Valves" specification found in this section.
- D. Vents:
 - 1. Hose end ball valve with cap. No coin valve/vents allowed.
- E. Drain:
 - 1. Hose end ball valve with cap connected to strainer.
- F. Ball Valves:
 - 1. Brass body for shutoff and hydronic balancing.

2.04 BALANCING VALVES/FLOW METERS

- A. Manufacturers:
 - 1. Flow Design
 - 2. Gerand
 - 3. Griswold
 - 4. K.G.
 - 5. Nexus
 - 6. HCl
 - 7. PRO Hydronic Specialties
 - 8. Nibco
 - 9. Tour & Anderson available through Victaulic Company of America
 - 10. Substitutions: See Section 01 6000 - Product Requirements.
- B. Calibrated ASME MFC-3M Venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate.
- C. Annular element flow stations with meter set.
 - 1. Venturi type flow meter fittings shall have a pressure drop at indicated flow not exceeding 10% of differential pressure reading.
 - 2. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
 - a. Pressure rating: 275 psi.

- b. Flow readings shall indicate the corrected solution flow reading based on 180 degrees F for hot water and 50 degrees F for chilled water. (Also anti-freeze solutions).
- 3. Flow meter fittings on pipe size 2" and under may be calibrated orifice type with integral tamperproof valve. Flow fitting meter shall be provided with quick connect couplings.
- 4. Orifice type flow fittings shall have an accuracy of not less than plus or minus 1% of actual flow. Orifice type flow meter fittings shall have a pressure drop at indicated flow not exceeding 25" of water.
- D. Size 2 inch and smaller:
 - 1. In addition to the previous noted balancing valves, manual globe style valves may be used.
 - 2. Each valve to be wye pattern, globe style with self-sealing EPDM measurement points, EPDM seat, and wheel handles with locking tamper-proof setting.
 - 3. Brass copper alloy body, EPDM o-ring seals. 4 turn digital readout hand wheel for balancing, hidden memory feature with locking tamper-proof setting. Brass shall be ISO 6509 compliant. Manual globe style flow meter valves shall have a pressure drop at indicated flow not exceeding 25" of water.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide a manual air vent consisting of 1/2" ball valve with hose end installed on a "T" at all high points of each system to enable complete venting.
- C. Perform tests determining strength of glycol and water solution and submit written test results.

3.02 MAINTENANCE

- A. See Section 01 7000 - Execution Requirements for additional requirements relating to maintenance service.
- B. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION

SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials.
 - 1. System cleaner.
 - 2. Closed system treatment (water).
- B. Glycol Equipment and Glycol
- C. Side-stream filtration equipment.
- D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2021.

1.02 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
 - 2. Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- C. Closeout Documents:
 - 1. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
 - 2. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
 - 3. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
 - 4. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.
 - 5. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements, for additional provisions.
 - b. Sufficient chemicals for treatment and testing during required maintenance period.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.
- B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

- A. System Cleaner:
 - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.
 - 2. Passivates steel surfaces

3. Non-corrosive to base metals
 4. Cleaner to be similar to Nalco #2567
- B. Closed System Treatment (Water):
1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
 2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
 3. Conductivity enhancers; phosphates or phosphonates.

2.03 SIDE STREAM FILTER

- A. Shall be constructed and stamped in accordance with ASME BPVC-IV.
- B. Filter housing shall be constructed of 304 stainless steel and brass. Housing shall be designed for use in high pressure (150 psi) systems. Housing shall be sized for flow listed on drawings.
- C. Filter shall be 25 micron with metal core and shall be rated for use in 30°F to 210°F fluids containing up to 35% glycol. Provide two (2) extra sets of filter cartridges to owner.
- D. Provide a in-line type sight flow indicator similar to Hedland EZ-View for measuring water flow through filter. Indicator shall be for flow listed on drawings, brass casing, magnet in metering tube with indicator protected by polycarbonate shield. Plastic casing shall not be acceptable.
- E. Replace existing sidestream filter cartridges a minimum of four times prior to turnover to owner.

2.04 GLYCOL SOLUTION

- A. Manufacturers
 1. Dow Chemical model Dowtherm SR-1.
 2. If expanding existing system, match existing glycol product.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Type - Inhibited Ethylene
- C. Glycol Solution:
 1. Heating Hot Water: Inhibited glycol and water solution mixed 35 percent glycol - 65 percent water, suitable for operating temperatures from minus 30 degrees F to 210 degrees F.
 2. Chilled Water: Inhibited glycol and water solution mixed 35 percent glycol - 65 percent water, suitable for operating temperatures from minus 30 degrees F to 210 degrees F.

PART 3 EXECUTION

3.01 PREPARATION

- A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- B. Place terminal control valves in open position during cleaning.
- C. Verify that electric power is available and of the correct characteristics.
- D. Clean and flush glycol system before adding glycol solution. Refer to Section 23 2500.
- E. Feed glycol solution to system through make-up connection as indicated on drawings. Vent system at high points to remove air and assure system is full. Set initial fill pressure at 5 psi (adjustable) at high point of system.

3.02 CLEANING AND FLUSHING SYSTEM

- A. This contractor shall provide to the engineer an initial water analysis of the water intended to be used for filling the heating and/or cooling system in the building. The analysis shall identify any potential issues related to the chemical treatment or introduction of glycol into the system. Proper action shall be implemented to assure quality water is provided for system use. Analysis shall be performed by an independent certified laboratory. Subsequent analysis as described herein shall be performed by the same laboratory.

- B. When connecting to an existing system the contractor shall obtain a water sample and send it to an independent lab for analysis. Any existing water quality issues will be addressed by the owner upon receipt of the analysis.
- C. This contractor shall thoroughly clean inside surface of boilers before placing them in operation. This shall include the use of caustic soda in the initial boiler water, thoroughly boiling out boiler, draining, flushing and refilling, all in accordance with the manufacturer's instructions. All dirt, grease, and other impurities shall be completely flushed out of the piping system as well as the boiler.
- D. The entire new hot water heating and chilled water cooling system shall be filled with clean water and operated for a period of at least 72 hours and then drained and completely flushed of all dirt, grease and other impurities in the system. The contractor shall then refill with clean water, vent all air, and operated during the construction period and up until a period immediately prior to complete building acceptance by Owner.
- E. Prior to complete acceptance of the building by the Owner, the entire hot water heating system shall again be drained, all strainers removed and cleaned, and the system again completely flushed of all dirt, grease and other impurities. This flushing of system shall be witnessed by the Architect's representative. At this time the entire new hot water heating and chilled water cooling system shall be refilled with water, corrosion inhibitors installed, all air vented out and the system placed in operation.
- F. All chilled water and hot water systems shall be flushed as specified. The seals in the pumps shall be removed after the flushing, and prior to the building being turned over to the owner, new factory pump seals shall be installed. The pump seals used to flush the system shall be turned over to the owner.
- G. This contractor shall provide the engineer with a water analysis upon completion of filling system. Water analysis shall indicate levels of inhibitors, quantities of impurities and PH level of water. Analysis shall be performed by a certified laboratory. Contractor shall provide a water analysis one year after system is placed in operation and provide additives to bring solution up to recommended levels. Testing shall be by an independent certified water testing laboratory at the contractors cost. Contractor shall provide a written statement indicating a one (1) year warranty on the installed water treatment system.
- H. During all flushing, system fluid temperatures shall not exceed recommended temperatures from the pre-treatment suppliers recommendations.
- I. Final flushing of the glycol piping system shall be done using a 1% solution of neutral PH iron cleaner prior to the introduction of the water-glycol mixture. Temperature of system fluids during final cleaning shall not be greater than chemical manufacturer's recommendation. At this time the heating and chilled water piping circuit shall be refilled with water-glycol solution containing corrosion inhibitors, all air vented out, and the system placed in operation.
- J. Contractor shall note special requirements for flushing radiant ceiling panel circuits prior to connecting panels. This will require a temporary by-pass at each circuit until the system is proven clean.
- K. This contractor shall provide shop drawings indicating all glycol, chemical additives, cleaners, etc. Contractor shall provide a bill of lading for product used in system.
- L. All hot water and chilled water systems including glycol systems shall have corrosion inhibitors provided and installed after final cleaning.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide concrete housekeeping pad for floor mounted equipment and tanks.

3.04 CLOSED SYSTEM TREATMENT

- A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- B. Introduce closed system treatment through bypass feeder when required or indicated by test.
- C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

3.05 INTRODUCTION OF GLYCOL SOLUTION

- A. This contractor shall collect and test a sample from each vessel used to transport the glycol and/or solution to the project site. The analysis shall identify any potential issues related to the chemical treatment or introduction of glycol into the system. Analysis shall be performed by an independent certified laboratory.
- B. The new heating coil piping circuit shall be filled with a 35% (+/- 2%) solution by volume of Dowtherm SR-1 heat transfer fluid. The solution shall be thoroughly mixed before being pumped into the piping systems. After the introduction of the solution into the piping systems, the systems shall be tested to insure a burst protection temperature of -35°F.
- C. (The new cooling coil piping circuit shall be filled with a 35% (35%-37%) solution by volume of Dowtherm SR-1 heat transfer fluid. The solution shall be thoroughly mixed before being pumped into the piping systems. After the introduction of the solution into the piping systems, the systems shall be tested to insure a burst protection temperature of -35°F.)
- D. This contractor shall provide a plastic laminated sign at the fill point of system. The sign shall be not less than 8-1/2" x 5" and shall be worded, "This system has been filled with a XX% solution of Dowtherm SR-1 (Dowfrost HD) and water. The solution should be tested each year for freezing protection and corrosion inhibitor."
- E. It will be this contractor's option to provide factory premixed R.O. solution or provide proper water treatment to attain R.O. quality for the final fluid.
- F. All glycol shall have surfactants and dispersants included in the inhibitor package of the glycol.
- G. Contractor shall provide documentation from an independent lab indicating levels of glycol concentration, amount of minerals, etc. as described below in the system after solution is filled, again after one month & finally one year after system has been put into operation. Contractor shall provide additional fill of solution & shall make adjustments to the system fluid as required to provide acceptable limits as described by the independent lab test. The contractor shall retest and make adjustments until all values are considered acceptable. Acceptable range for system fluids include:
 - 1. Clarity shall be considered "clear", (not cloudy).
 - 2. Sediment shall have a wt% of <0.01.
 - 3. Fluid shall have a PH level of 8-10.5.
 - 4. Reserve alkalinity shall be >8 ml of 0.1N HCl.
 - 5. Chloride levels shall be <100 ppm Cl.
 - 6. Sulfate levels shall be <250 ppm SO₄.
 - 7. Total hardness shall be <200 ppm CaCO₃.
 - 8. Ferrous metal corrosion rate shall be <0.5 mils per year (mpy).
 - 9. Copper corrosion rate shall be <0.5 mils per year (mpy).
 - 10. Nitrite levels shall be <100 ppm NO₂.
 - 11. Nitrate levels shall be <100 ppm NO₃.
 - 12. Mercaptobenzothiazole levels shall be <100 ppm MBT.
 - 13. Glycol in system shall be of the type specified and within 1% of the amount specified.
 - 14. Glycols other than specified to be in system fluid shall be <1 % volume in the system.

3.06 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
 - 1. Provide minimum of two hours of instruction for two people.
 - 2. Have operation and maintenance data prepared and available for review during training.
 - 3. Conduct training using actual equipment after treated system has been put into full operation.

3.07 MAINTENANCE

- A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.
- B. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of Owner.
- C. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.
- D. Provide monthly technical service visits to perform field inspections and make water analysis on-site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
- E. Provide laboratory and technical assistance services during this maintenance period.
- F. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Flexible ducts.
- C. Ducts for kitchen exhaust applications.

1.02 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. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- E. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.
- F. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.
- G. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.
- H. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide data for duct materials.
- C. Closeout Documents:
 - 1. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).
 - 2. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.
- C. Duct Material in accordance with Allowed Static Pressure Range:

1. Medium Pressure Supply (from supply fan to VAV inlet): 4 in-wc, galvanized steel
 2. Low Pressure Supply (from VAV outlet to air outlet): 2 in-wc, galvanized steel
 3. Return and Relief: 2 in-wc, galvanized steel
 4. General Exhaust: 2 in-wc, galvanized steel
 5. Outside Air Intake: 2 in-wc, galvanized steel
 6. Transfer Air and Sound Boots: 1 in-wc, galvanized steel
- D. Duct Sealing and Leakage in accordance with Static Pressure Class:
1. As indicated above for duct material pressure class.
- E. Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 2. Ductwork shall be fabricated of minimum 26 gauge galvanized metal.
 3. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
 4. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 5. Construct tee's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal wi. Short radius elbows (1 times duct width) shall be allowed if a single radius turning vane is installed at 1/3 width-distance from the inner radius.
 6. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated or required.
 7. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
 8. Provide transitions in duct size from trunk or runout ducts shown on the drawings to the inlet dimensions of any device connected to the duct. Transitions shall be sealed air tight.
 9. Water tight drip pans shall be provided below all power vent, relief vent, gravity vent, fresh air and exhaust openings through roof, either built into the ductwork or, if no duct is installed, independently suspended below opening.

2.02 METAL DUCTS

- A. Material Requirements:
1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Round Ducts
1. All supply duct shall be round spiral lockseam construction. Round duct shall be of standard spiral gauge as follows:

duct diameter	0-2 inches water column	>2-4 inches water column
Up to 8 inch	28 gauge	26 gauge
9 to 14 inch	28 gauge	26 gauge
15 to 26 inch	26 gauge	24 gauge
27 to 36 inch	24 gauge	22 gauge
37 to 42 inch	22 gauge	20 gauge
44 to 50 inch	22 gauge	20 gauge
52 to 60 inch	20 gauge	18 gauge
62 to 84 inch	18 gauge	18 gauge

2. Lockseam or 'Snappy' fittings and pipe shall not be allowed on any exposed round ductwork.

3. Duct shall be provided in continuous lengths, except where interrupted by fittings or diffuser takeoffs.
4. All branch takeoffs shall be made using high efficiency type takeoff fittings.
5. For all round ductwork up to and including 16" diameter, the duct sections shall be joined using a premanufactured coupling connection. When a connection is made, it shall be done by first coating the inside of the two pieces of ductwork thoroughly for approximately 3" with duct sealant. Duct sealant shall be used on fresh air ductwork & all outside & relief air ductwork within 15' of building penetration as well as ductwork located in an attic space. Sealant shall be UL 181B-M listed and have a service range of -20 degrees F to 200 degrees F. The connector shall then be slid on so that the sealant is located between the outside wall of the connector and the inside wall of the ductwork. The coupling connection shall be attached to both pieces of ductwork it is connecting with either screws or rivets.
6. For all round ductwork 18" diameter and larger, the duct sections shall be joined together using a premanufactured Flange with Barrel Clamp type connector. Provide a neoprene gasket between the flanges to prevent air leakage. When a connection is made, it shall be done by first coating the inside of the two pieces of ductwork thoroughly for approximately 1-1/2 inches, or the length of the flanged connection, with Ductmate Proseal, indoor/outdoor, water based sealer, with 0 flame/smoke rating equal. Duct sealant shall be used on fresh air ductwork & all outside & relief air ductwork within 15' of building penetration as well as ductwork located in an attic space. Sealant shall be UL 181B-M listed and have a service range of -20 degrees F to 200 degrees F. The flanged connectors shall then be slid on so that the sealant is located between the outside wall of the flanged connectors and the inside wall of the ductwork. The flanges shall be connected to both duct pieces with screws, rivets, or by spot welding.
7. For spaces without ceilings (other than mechanical rooms), exposed, uninsulated ductwork shall be galvanealed for field painting unless otherwise noted on plan. Paint color shall be selected by architect.
8. Wire rope hanging system may be used for support of round and/or oval ductwork. System shall be similar to Ductmate Cable Shark or Gripple. System shall consist of wire rope material with a locking mechanism for wire adjustment. Locking mechanism shall be installed according to manufacturer's recommendations. Top termination of hanger shall be in accordance with SMACNA Standards.
9. Acceptable manufacturers include Norlock, Semco, Tangent Air, United McGill, Sheet Metal Connectors or approved equal.

2.03 JOINT SEALERS AND SEALANTS

- A. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts. Sealant shall be gray in color or a color matching the duct system on which it is applied.
 2. All fresh air intake and relief air ductwork between louver/hood and air handling unit shall have all joints sealed watertight. Sealant shall be UL 181B-M listed and have a service range of -20 degrees F to 200 degrees F.
 3. All joints of low-pressure duct shall be carefully sealed to eliminate air leakage. Sealer shall be spread on the inside of all slips and longitudinal joints and then the duct assembled. Sealer shall be applied to all screw heads, connecting laps, and corner joints as well as all joints of flexible duct. Sealer shall be suitable for indoor/outdoor HVAC duct systems and shall be applied in accordance with manufacturer's recommendations. Duct sealants shall be U.L. Classified with a flame spread rating of 25 or less and a smoke developed rating of 50 or less. Sealants shall be UL 181B-M listed and have a service range of -20 degrees F to 200 degrees F

4. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
5. Manufacturers:
 - a. Carlisle HVAC Products; Hardcast Iron-Grip 601 Water Based Duct Sealant: www.carlislehvac.com/sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 FLEXIBLE DUCTS

- A. Flexible Ducts: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
 1. Flexible duct shall meet NFPA 90A and 90B requirements and be UL listed 181 Class 1 Air Duct with a flame spread less than 25 and smoke developed less than 50.
 2. Insulation: Fiberglass R-6.0 insulation with polyethylene vapor barrier film.
 3. Maximum Velocity: 6000 fpm.
 4. Temperature Range: Minus 20 degrees F to 210 degrees F.
 5. Flex duct shall only be used in locations explicitly indicated on the drawings (generally limited supply air device connections and limited to 5 foot length without change in direction).
 6. Flex duct shall not be used above inaccessible ceilings.
 7. No flexible "duct connectors" shall be allowed.
 8. Manufacturers:
 - a. Wiremold.
 - b. Thermaflex.
 - c. Flexmaster.
 - d. Atco.

2.05 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

- A. Provide ductwork, fittings, and appurtenances in accordance with NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.
- B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.
- C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.
- D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.
- E. Dishwasher Exhaust Duct:
 1. Duct Size: 1 in-wc pressure class, galvanized steel.
 2. Fabricate using 18 gauge, 0.050 inch thick, single wall sheet steel with continuous external welded joints to form rectangular sections.
 3. Flanged joints on the final section of ductwork shall be allowed for connection to terminal equipment. Flanged joints shall be carefully constructed and sealed. Ductwork shall slope back to dishwasher. Ductwork shall be fabricated such that no joint connection extends into the air stream. A drain pan and ¾" drain shall be provided at the base of each vertical rise and any low point where water may collect. Provide a minimum of one drain per system. All drains shall be routed to the nearest floor drain or mop basin.
- F. Kitchen Hood and Grease Exhaust Duct:
 1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
 2. 2 inch w.g. pressure class, 16-gage black iron, 18-gage stainless steel, or a listed and labeled factory built commercial kitchen grease duct.
 3. Joints, seams, and penetrations of grease ducts shall be made with a continuous liquid tight weld or braze made on the external surface of the duct system. Duct Joints shall be butt joints or overlapping joints of either the telescoping or bell type. The length of the

overlap shall not exceed 2" and the difference between the inside cross-sectional dimension of overlapping sections shall not exceed 0.25 inches.

4. Duct to exhaust fan connections shall be flanged and gasketed at the base of the fan for listed and labeled vertical discharge fans; shall be flanged, gasketed and bolted to the inlet of the fan for side inlet utility fans; and shall be flanged, gasketed, and bolted to the inlet and outlet of the fan for inline fans.
5. Duct systems serving a Type I hood shall be constructed and installed so that grease cannot collect in any portion thereof, and the system shall slope not less than ¼ unit vertical in 12 units horizontal toward the hood or approved grease reservoir. Where horizontal ducts exceed 75' in length, the slope shall not be less than 1 unit vertical in 12 units horizontal.
- 6.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. All branch takeoffs shall be made using high efficiency type takeoff fittings similar to Sheet Metal Connectors Super HETO. All takeoffs shall be provided with a manual volume damper.
- C. Install products following the manufacturer's instructions.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- E. Flexible Ducts: Connect to metal ducts with duct sealer on inside and outside of flex duct as well as strap clamp around duct end. Tape outer jacket to diffuser neck..
- F. Dryer Ducts: Label ductwork in concealed within building construction.
- G. Where duct liner is installed in ducts, the duct size indicated accommodates the liner such that the gross duct dimension is that shown on the drawings. No increase in duct size is necessary to accommodate duct liner thickness.
- H. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.
- I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- J. Use double nuts and lock washers on threaded rod supports.
- K. Provide galvanized iron drip pans under water, soil, waste, drain or heating system piping which runs over electric switchboards, elevator controllers, or electric motor starters. Drip pans shall have all joints and seams soldered water tight. Each drip pan shall have a drain piped to discharge where shown on the drawings, or if not shown, to discharge over nearest available drain.
- L. Sealing of Ductwork:
 1. Joints of all supply, return and exhaust ducts shall be carefully sealed to eliminate air leakage. Sealer shall be spread on the inside of all slips and longitudinal joints and then duct assembled. Sealer shall also be applied to exterior to all joints. Sealant shall be UL 181B-M listed and have a service range of -20 degrees F to 200 degrees F.
 2. Seal all ductwork to seal class A. This will require all ductwork to have all joints, seams and wall penetrations sealed. Sealing must be sufficient to achieve a leakage class 6. This means that 6 CFM of leakage per 100 sq ft of duct surface is the maximum allowable threshold if tested at 1 inch test pressure. See additional duct sealing requirements in the latest edition of the SMACNA manual "HVAC Air Duct Leakage Test Manual."

3. If review of the testing and balancing report reveals duct leakage in excess of the leakage class 6, the contractor shall be required to seal the ductwork in place. Duct sealing shall be as follows:
 - a. Repair all major leakage sites ($> \frac{1}{2}$ inch across) using mastic and fiberglass mesh tape.
 - b. Assure the structural integrity of all mechanical joints of existing ductwork using mastic and fiberglass mesh tape.
 - c. Seal existing ductwork from the inside using automated, UL Certified, aerosolized sealant injection as manufactured by Aeroseal
 - d. Protect air-moving equipment, air inlets and outlets, and other devices and appurtenances as recommended by the manufacturer.
 - e. Protect occupied spaces from aerosol particles using manufacturer procedures.
 - f. Provide pre-sealing, post-sealing and sealing profile certificates for all sections sealed.
 - g. Seal all injection and test holes in existing ductwork using patching plates sealed with mastic.
 - h. Any insulation (internal or external) shall be replaced on the patching plate.
 4. Sealant shall be applied neatly. Satisfactory appearance shall be maintained on all exposed ductwork.
- M. Testing and Adjusting
1. The supply, return and exhaust ductwork shall be pressure tested by Mechanical Contractor to assure minimal duct leakage. The Testing and Balancing sub-contractor shall supply testing equipment for this contractor to pre-test all ductwork prior to the Testing and Balancing sub-contractors verification of leakage. It shall be the Mechanical Contractor's responsibility to coordinate and schedule duct installation and the associated pressure testing with the testing and balancing sub-contractor, prepare all ductwork for leak testing, and to make all necessary modifications to the ductwork to meet the duct air tightness requirements as stated herein and as recommended by the Testing and Balancing Contractor.
 2. An extra set of Mechanical drawings shall be supplied to the Testing and Balancing Contractor at the beginning of the project, so that the leak testing percentages can be written on the print for each section of ductwork during the leak testing process. Depending upon capacity of testing equipment, the exact size and length of duct sections that can be tested will vary. Confirm and coordinate duct section sizes with Testing and Balancing sub-contractor. Progress reports of pressure testing shall be submitted at intervals of 25%, 50%, 75% and 100% of work completed. Refer to Section 23 0593 - Testing, Adjusting, and Balancing for HVAC of these specifications for more information.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backdraft dampers - metal.
- B. Combination fire and smoke dampers.
- C. Duct access doors.
- D. Duct test holes.
- E. Fire dampers.
- F. Volume control dampers.
- G. Motor Operated Dampers
- H. Miscellaneous Products:
 - 1. Internal strut end plugs.
 - 2. Duct opening closure film.

1.02 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- E. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
 - 2. Indicate for shop fabricated assemblies including volume control dampers.
- C. Closeout Documents:
 - 1. Project Record Drawings: Record actual locations of access doors and test holes.
 - 2. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements for additional provisions.
 - b. Extra Fusible Links: One of each type and size. Additional links shall be turned over to the Owner at the end of the project.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
 - 1. Nailor Industries, Inc: www.nailor.com.

2. Pottorff: www.pottorff.com/#sle.
 3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
 4. Greenheck: www.greenheck.com
 5. Loren Cook: www.lorencook.com
 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
 - C. Backdraft dampers shall be the counterbalanced type, with a screw type adjustment. Flanges shall be provided on either the intake or discharge side of the damper depending on installation needed in the curb.
 - D. Damper blades shall consist of an extruded aluminum channel frame 0.063 in. thick, with 2 in. depth. The blades shall be 0.05 in. thick, extruded aluminum. Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval. Damper shall be suitable for pressures to 2.5 in. wg, velocities to 2,000 ft./min and temperatures to 180 °F. Testing and ratings to be in accordance with AMCA Standard 500.
 - E. The mechanical contractor shall work with the testing and balancing contractor to insure the dampers are adjusted during balancing to properly control building pressurization.
 - F. Spring type dampers will not be allowed.
 - G. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Extruded aluminum, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
 - H. Backdraft dampers shall have an air leakage rate not greater than 20 cfm/sq ft. where not less than 24 inches in either dimension and 40 cfm/sq ft. where less than 24 inches in either dimension. Leakage rate shall be at a pressure of 1.0" w.c.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
 1. Nailor Industries, Inc: www.nailor.com.
 2. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
 3. Air Balance: www.airbalance.com
 4. Greenheck: www.greenheck.com
 5. Ruskin: www.ruskin.com
 6. Pottorff: www.pottorff.com
 7. Aire Technologies: www.airetechnologies.com
 8. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper. Sleeve shall extend a minimum of six (6) inches on either side of the wall. Sleeve shall be furnished with metal thickness in accordance with UL 555.
- D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, blade edge seals of silicone rubber, and lock, and 1/2 inch actuator shaft.
- E. Motors for operation of fire/smoke dampers shall be spring return, normally closed type, 120V and shall be furnished complete with damper linkage, etc., by the damper manufacturer.

- F. Damper shall be furnished with a two-position indicator switch linked to the damper blades to provide remote indication of damper position.
- G. Out of wall" fire/smoke dampers where required shall be furnished with thermal blanket around the sleeve. All thermal insulating blankets shall be a part of an approved assembly.
- H. Electro Thermal Link: Fusible link melting at 165 degrees F; line or low voltage coordinated with fire alarm; UL listed and labeled. Upon detection, device shall close and lock damper during test, smoke detection, power failure or fire conditions through the actuator closure spring. At no time shall the actuator disengage from the damper blades. Device shall allow damper to be manually reset after test, smoke detection or power failure conditions.
- I. Fire/smoke dampers shall be installed with access panel located in ductwork on both sides of wall arranged to provide access to fusible link, actuator and blades for servicing.
- J. Installation of fire/smoke dampers shall be in accordance with latest edition of the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.
- K. All combination fire/smoke dampers shall be tested by the contractor to insure proper operation without binding. The contractor shall prepare a written report listing each installed device, location, system served and date tested and shall indicated the damper that the operating correctly. This report shall be included in the Operation and Maintenance Manual.

2.03 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Nailor Industries, Inc: www.nailor.com.
 - 2. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
 - 3. CESCO Advanced: www.cescoproducts.com
 - 4. Kees: www.kees.com
 - 5. National Controlled Air: www.ncamfg.com
 - 6. Vent Products: www.ventproducts.com
 - 7. Aire Technologies: www.airetechnologies.com
 - 8. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Provide access doors with framed edges, equipped with latches in ductwork for inspection of all automatic operated dampers, etc.
- D. Access doors for round ducts shall be rectangular and shall be constructed in accordance with SMACNA HVAC Duct Construction Standards (latest edition). Access door dimensions shall not be less than 2" smaller than duct diameter. The door shall be provided with a handle and retaining ring. Access doors shall be equal to Ductmate, Model FD1 (rectangular door).
- E. Access doors for rectangular ducts shall be similar to Air Balance Model FSA 101 and constructed of 24 gauge galvanized steel with a 1" thick insulated door, frame and double cam latches. Frame shall be gasketed to minimize air leakage.
- F. Access doors for fire dampers, smoke dampers and fire/smoke dampers shall be a minimum of 12"x 12" in size. Increase duct size as required for access door installation.
- G. All duct access doors shall be accessible through walls, ceilings or floors. Provide access doors as required to reach duct access doors.
- H. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

1. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FIRE DAMPERS

- A. Manufacturers:
 1. Nailor Industries, Inc: www.nailor.com.
 2. Pottorff: www.pottorff.com/#sle.
 3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
 4. Air Balance: www.airbalance.com
 5. Greenheck: www.greenheck.com
 6. Aire Technologies: www.airetechnologies.com
 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated. Dampers shall be 1-½ hour rated unless otherwise noted on the drawings as 3 hour rated. Installation of fire dampers shall be in accordance with latest edition of the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.
- C. Horizontal or Vertical Dampers: Galvanized steel, 22 gage, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations or vertical installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- E. Dampers shall be furnished with galvanized steel sleeve that extends a minimum of six (6) inches on either side of the wall. Sleeve shall be furnished with metal thickness in accordance with UL 555.
- F. Multiple Blade Dampers: 16-gauge, 0.0598-inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fire dampers shall be installed with access panel located in ductwork arranged to provide access to fusible link and blades for servicing.
- H. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 1. Nailor Industries, Inc: www.nailor.com.
 2. Pottorff: www.pottorff.com/#sle.
 3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
 4. Aire Technologies: www.airetechnologies.com
 5. Greenheck: www.greenheck.com
 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Each register and diffuser air terminal shall be provided with a damper in the duct leading to the air terminal. Each branch duct leading to a group of two or more air terminals shall be provided with a damper at the point where the branch leaves the main duct. Dampers shall be installed with a maximum of 1/8" clearance all around. Dampers shall be installed so that they can be adjusted at any time after completion of the work, and shall be fitted with "Parker", or equal, damper quadrants. Quadrants shall be plainly marked to indicate position of damper. All dampers shall be tight fitting and be reinforced to prevent vibration. Damper handles shall be extended type for insulation clearance.

- D. Balancing dampers serving the inlet of a VAV box shall be installed in the size indicated for the high efficiency take off serving the VAV (not VAV inlet size). VAV inlet dampers shall be similar to Duro Dyne Corp. HDJD damper with continuous rod for 2" wg and over. Dampers shall be constructed of a minimum 22 gauge galvanized steel blades with high strength corrosion resistant 3/8" square rod extending 3 inches beyond the blade to accommodate exterior duct insulation. Dampers shall be provided with regulators similar to Duro Dyne ESO with a stand height of 1-1/2" to accommodate insulation thickness & designed for square shafts with locking wing nut to secure damper while balancing. Where damper shafts penetrate through the duct, a closed end bearing shall be installed on the end without the regulator and an open end bearing on the regulator end.
- E. Where damper shafts penetrate duct walls, the openings shall be properly sealed to eliminate air leakage.
- F. Each damper handle, where located above a lay-in tile ceiling, shall be identified by attaching section of flagging tape to the end of the damper handle. Length of flagging tape shall be approximately 12" long with longer or shorter lengths determined based on location of installation and clearance requirements. The flagging tape shall be high visibility, similar to pink or orange, to allow for ease of locating damper locations.
- G. Where dampers are located in ducts concealed above non-accessible ceiling, the dampers shall be equipped with Ventlock concealed, flush cap regulators.
- H. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
 - 1. Manufacturers:
 - a. Carlisle HVAC Products; Dynair End Bearing Leak Resistant Sets: www.carlislehvac.com/#sle.
 - b. Elgen Manufacturing Company, Inc; Snap-In Bushing: www.elgenmfg.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- I. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.
 - 4. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 MOTOR OPERATED DAMPERS

- A. All automatic motor operated louver dampers shall be furnished and set in place by this contractor. In addition to the ventilation drawings, the contractor shall refer to the automatic temperature control diagrams for locations of where motorized dampers are required. It shall be the responsibility of this contractor to verify all damper locations and sizes for the job. Furnish this information to the temperature control subcontractors so that they may provide the appropriate motors for the dampers.
- B. Louver blade dampers
 - 1. Dampers shall be louver blade type, factory fabricated and with factory assembled linkages. Blades shall have interlocking edges or shall be provided with compressible seals at point of contact. Damper blades shall have steel trunnions mounted in bronze sleeve, nylon or ball bearings. Dampers shall be not be more than 48 inches in length between bearings. Modulating dampers shall be of the opposed blade type. Dampers when closed shall be guaranteed by the manufacturer not to leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure. Dampers shall be installed with

- operators having sufficient power to limit leakage to the rate specified. Dampers shall have bar or channel frames, and all parts of dampers shall be factory finished with two coats of rust inhibitive paint or shall be zinc coated.
2. Acceptable manufacturers shall be Ruskin, Greenheck, National Controlled Air, Safe Air, Vent Products, Cesco, Nailor, Tamco or an approved equal.
- C. Airfoil blade dampers
1. Dampers shall be airfoil blade type, factory fabricated and with factory assembled linkages. Blades shall have overlapping edges (not just overlap seals) with compressible seals at points of contact. Damper blades shall be permanently secured to blade shaft. Blade shaft shall mount to frame with double bearing allowing rod to rotate while outer bearing remains fixed. Dampers shall be not more than 48 inches in length between bearings. Modulating dampers shall be of the opposed blade type. Dampers when closed shall be guaranteed by the manufacturer not to leak in excess of 10 cfm per square foot at 4 inches water gauge static pressure. Dampers shall be installed with operators having sufficient power to limit leakage to the rate specified. Dampers shall have bar or channel frames, and all parts of dampers shall be minimum of 12 Gauge extruded aluminum.
 2. Acceptable manufacturers shall be Arrow, Cesco, Greenheck, Nailor, Ruskin, Tamco or an approved equal.
- D. Insulated, thermally broken dampers
1. Damper frame shall be insulated with styrofoam on four sides and be thermally broken by means of polyurethane resin pockets complete with thermal cuts. Blades shall be extruded aluminum, internally insulated with expanded polyurethane foam and shall be thermally broken. Damper blades shall be permanently secured to blade shaft. Blade shaft shall mount to frame with double bearing allowing rod to rotate while outer bearing remains fixed. Blade and frame seals shall be of extruded silicone and be secured in an integral slot within the aluminum extrusion. Dampers shall be not more than 48 inches in length between bearings. Modulating dampers shall be of the opposed blade type. Dampers when closed shall be guaranteed by the manufacturer not to leak in excess of 5 cfm per square foot at 4 inches water gauge static pressure and -40° F. Dampers shall be installed with operators having sufficient power to limit leakage to the rate specified. Dampers shall have channel frames, and all parts of dampers shall be minimum of 0.075" thickness extruded aluminum.
 2. Acceptable manufacturers shall be Tamco, Arrow, Greenheck, or Ruskin.

2.08 MISCELLANEOUS PRODUCTS

- A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.
1. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Internal Duct Reinforcement - Conduplugs: www.carlislehvac.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils.
 2. High tack water based adhesive.
 3. UV stable light blue color.
 4. Elongation Before Break: 325 percent, minimum.
 5. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, before turning vanes on duct mains, and elsewhere as indicated. Provide minimum 12 by 12 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide identification of access doors for Fire Dampers, Smoke Dampers, and Combination Fire/Smoke Dampers.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.
- J. Use splitter dampers only where indicated.
- K. Provide balancing dampers on high velocity systems where indicated. See Section 23 3600.
- L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- M. Provide balancing dampers on all takeoffs serving terminal devices.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS AND EXHAUST SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.
- B. Ceiling exhaust fans.
- C. Inline centrifugal fans and blowers.

1.02 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- B. AMCA 99 - Standards Handbook; 2025.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.
- E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.
- G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- H. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Closeout Documents:
 - 1. Manufacturer's Instructions: Indicate installation instructions.
 - 2. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
 - 3. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements, for additional provisions.
 - b. Extra Fan Belts: One set for each individual fan.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS (UNLESS NOTED OTHERWISE BELOW)

- A. Greenheck Fan Corporation: www.greenheck.com.
- B. Loren Cook Company: www.lorencook.com.
- C. Twin City Fan & Blower: www.tcf.com/#sle.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Enclosed Safety Switches: Comply with NEMA EN 10250.
- H. Provide fans sized with maximum RPM at 10% above scheduled RPM.

2.03 ROOF EXHAUSTERS

- A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- B. Roof Curb: 24 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips and R-10 insulation.
- C. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- D. Motorized Damper: motorized actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.
- E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 CEILING EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.
- B. Ceiling mounted exhaust fans shall be of the centrifugal direct drive type. The fan housing shall be constructed of steel. The access for wiring shall be external. The motor shall be mounted on vibration isolators. The fan wheel shall be of the forward curved centrifugal type and dynamically balanced. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be UL/cUL listed.
- C. Duct mounted exhaust, supply or return air fans shall be of the centrifugal direct drive type. The fan housing shall be constructed of steel. The steel duct collar shall accept round ductwork. The access for wiring shall be external. The motor shall be mounted on vibration isolators. The fan wheel shall be of the forward curved centrifugal type and dynamically balanced. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be UL/cUL Listed.
- D. Furnish with each fan a wall/roof cap termination per the manufacturer's instructions.
- E. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- F. Grille: Molded white plastic.
- G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.05 INLINE CENTRIFUGAL FANS AND BLOWERS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient rubber mounted motor, gravity backdraft damper in discharge, square duct mounting collars, hingeable service floor, vibration isolators.

- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Install backdraft dampers on inlet to roof and wall exhausters.
- E. Provide gravity backdraft damper on outlet from cabinet and ceiling exhauster fans and as indicated.
- F. All mechanical equipment shall be lubricated. All equipment shall be operated for a period of sufficient duration to insure its proper mechanical operation.
- G. Any changing of pulley sizes if found necessary when testing systems, shall be done by this contractor. Any additional dampers which may be found necessary to get proper air supply and quantity shall be furnished by this contractor at no expense to the Owner.

END OF SECTION

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct terminal units.

1.02 REFERENCE STANDARDS

- A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
- B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
- C. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2025.
- D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).
- E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.
- F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.
- I. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
 - 2. Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
 - a. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc.
 - 3. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.
- C. Closeout Documents:
 - 1. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
 - 2. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
 - 3. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
 - 4. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
 - 5. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements for additional provisions.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide 18-month manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

- A. Manufacturers:
 - 1. Price Industries, Inc: www.priceindustries.com.
 - 2. Trane, a brand of Ingersoll Rand: www.trane.com.
 - 3. Titus: www.titus-hvac.com
 - 4. Enviro-tec: www.enviro-tec.com
 - 5. Nailor Industries Inc[<>]: www.nailor.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. General:
 - 1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
 - 2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
 - 3. Units shall deliver the maximum scheduled cfm with an air pressure drop not to exceed 0.35", including all accessories listed below.
- C. Unit Casing:
 - 1. Minimum 22 gauge, 0.0299 inch galvanized steel.
 - 2. Air Inlet Collar: Provide round, suitable for standard duct sizes.
 - 3. Unit Discharge: Rectangular, with slip-and-drive connections.
 - 4. Provide control cabinet enclosure mounted to VAV box. Control Cabinet access door shall match construction of VAV box.
 - 5. Acceptable Liners:
 - a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071. All terminal coil casings shall be constructed and insulated to the same standard as the VAV box.
 - 1) Secure with adhesive.
 - 2) Coat edges exposed to airstream with NFPA 90A approved sealant.
 - 3) Cover liner with non-porous foil.
 - b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.
- D. Damper Assembly:
 - 1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
 - 2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
 - 3. Incorporate low leak damper blades for tight airflow shutoff.
 - a. Air Leakage Past Closed Damper: Maximum two percent of unit maximum airflow at 3 in-wc inlet static pressure, tested in accordance with ASHRAE Std 130.
- E. Hot Water Heating Coil:
 - 1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
 - a. Access Door: Gasketed, cam-lock latches, and insulated located on bottom.
 - b. Right or left coil inlets. Coordinate prior to ordering.

2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
 3. Coil leak tested to minimum 350 psig.
 4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.
- F. Controls:
1. DDC (Direct-Digital Controls):
 - a. See Section 23 0923. Controls for VAV box shall be furnished by the temperature controls contractor for field mounting,
 2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
 - a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are suitable for installation.
- B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. See drawings for the size(s) and duct location(s) of the air terminal units.
- D. Provide ceiling access doors or locate units above easily removable ceiling components.
- E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
- F. Do not support from ductwork.
- G. Connect to ductwork in accordance with Section 23 3100.

3.03 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.

3.05 CLEANING

- A. Vacuum clean coils and inside of units.
- B. Install new filters.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training for additional requirements.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
 - 1. Perforated ceiling diffusers.
- B. Rectangular ceiling diffusers.
- C. Registers/grilles:
 - 1. Ceiling-mounted, egg crate exhaust and return register/grilles.
 - 2. Ceiling-mounted, exhaust and return register/grilles.
 - 3. Ceiling-mounted, supply register/grilles.
 - 4. Wall-mounted, supply register/grilles.
 - 5. Wall-mounted, exhaust and return register/grilles.
- D. Roof hoods.

1.02 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
- C. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com.
- B. Price Industries: www.price-hvac.com/#sle.
- C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com.
- D. Tuttle and Bailey: www.tuttleandbailey.com/#sle.
- E. Nailor: www.nailor.com
- F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square plaque diffuser to discharge air in 360 degree pattern.
- B. Connections: Round.
- C. Frame: Provide inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel finish.
- E. Color: Standard White.

2.03 PERFORATED FACE CEILING DIFFUSERS

- A. Type: Perforated face with fully adjustable pattern and removable face.
- B. Frame: Inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Stainless steel.
- D. Color: Standard White.

2.04 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.
- B. Frame: 1-1/4 inch margin with concealed mounting and gasket.
- C. Construction: Made of aluminum extrusions with factory enamel finish.
- D. Color: As selected by Engineer from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.05 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.
- B. Frame: 1-1/4 inch margin with concealed mounting.
- C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Color: To be selected by Engineer from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.06 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

- A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.
- B. Fabrication: Grid core consists of aluminum with baked enamel finish.
- C. Color: To be selected by Engineer from manufacturer's standard range.
- D. Frame: Channel lay-in frame for suspended grid ceilings.

2.07 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Color: To be selected by Engineer from manufacturer's standard range.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.08 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with one-way deflection.
- B. Fabrication: Aluminum extrusions with factory clear lacquer finish.
- C. Color: To be selected by Engineer from manufacturer's standard range.

- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.09 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel frames and blades, with factory baked enamel finish.
- D. Color: To be selected by Engineer from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.10 ROOF HOODS

- A. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).
- B. Hoods shall be weatherproof, low contour type, constructed with all aluminum housings, be furnished with bird guard, aluminum insect screen, and square or rectangular curb cap, and shall have hinging arrangement to allow access to dampers or control equipment.
- C. Intake hoods shall be provided with optional 12" tall base.
- D. Relief/exhaust hoods shall be provided with optional 12" tall base.
- E. All intake hoods shall be furnished with a 6" skirt/shroud that extends from the edge of the hood down. Skirt shall be attached to the bottom edge of the hood overhang. Skirt shall be the same material as the hood.
- F. All relief/exhaust hoods shall be furnished with a 6" skirt/shroud that extends from the edge of the hood down. Skirt shall be attached to the bottom edge of the hood overhang. Skirt shall be the same material as the hood.
- G. Curbs for air intakes shall be furnished in sizes suitable for the curb cap of the vent or intake served. Curbs for fresh air intakes shall be sized so that the bottom of the hood shroud is a minimum of 36" height above the finished roof surface. Provide additional blocking or curb extension to achieve this height. Curbs for intake vents shall be insulated with minimum R-12 insulation.
- H. Curbs for relief vents and gravity vents shall be furnished in sizes suitable for the curb cap of the vent or intake served. Curbs for relief vents and gravity vents shall be a minimum of 30" height. Provide additional blocking or curb to achieve this height. Curbs for relief vents shall be insulated with minimum R-12 insulation.
- I. Fabricate louver penthouses with mitered corners and reinforce with structural angles.
- J. All relief/exhaust hoods shall be furnished with a backdraft damper.
- K. Roof hoods shall be furnished with a backdraft damper.
- L. Acceptable manufacturers shall be Greenheck, Cook, Twin City Fan or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Paint ductwork visible behind air outlets and inlets matte black, see Section 09 9123.

END OF SECTION

SECTION 23 7313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

<<< UPDATE NOTES

PART 1 GENERAL

2.01 SECTION INCLUDES

- A. Casing construction.
- B. Fan section.
- C. Coil section.
- D. Filter and air cleaner section.
- E. Damper section.

2.02 RELATED REQUIREMENTS

- A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
- B. Section 23 3416 - Centrifugal HVAC Fans.
- C. Section 23 4000 - HVAC Air Cleaning Devices.
- D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

2.03 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
- B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
- C. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- D. AMCA 99 - Standards Handbook; 2025.
- E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.
- F. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.
- G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.
- H. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.
- I. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2025.
- J. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

2.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of air handler with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

2.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings:

1. Product Data:
 - a. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
 - b. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
 - c. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
 - d. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
 - e. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
 2. Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- C. Closeout Documents:
1. Specimen Warranty: Submit sample of manufacturer's warranty.
 2. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
 3. Manufacturer's Instructions: Include installation instructions.
 4. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
 5. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements for additional provisions.
 - b. Extra Fan Belts: One set for each unit.
 - c. Extra Filters: Two sets for each unit.

2.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

2.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

2.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

3.01 MANUFACTURERS

- A. Carrier Corporation: www.carrier.com.
- B. Daikin Applied: www.daikinapplied.com.
- C. Trane Inc: www.trane.com.
- D. York International Corporation / Johnson Controls Inc: www.york.com.

- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Duct connections and equipment clearances were based on the manufacturer scheduled. Any deviations in size and/or configuration shall be the responsibility of the contractor. Air handling units by Trane, Carrier and York will be acceptable if of a similar type and grade and if of approximately the same general overall dimensions. Quality, construction and performance must be equal to or better than that specified.

3.02 CASING CONSTRUCTION

- A. Full Perimeter Base Rail:
 - 1. Construct of galvanized steel.
 - 2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.
 - 3. In addition to the internal isolation of the fan/motor, the entire unit shall be isolated from the floor with neoprene pads. Provide Mason Super W neoprene pad between the base rails and the housekeeping pad or floor. The pad shall be installed under entire length of air handling unit. Pads shall be 4" wide by 3/4" thick.
- B. Casing:
 - 1. Construct of one piece, insulated, double wall panels. Panels and access doors shall be constructed as a 2-inch thick, thermal broke double wall assembly, injected with foam insulation for an R-value of not less than R-13
 - 2. Provide mid-span, no through metal, internal thermal break.
 - 3. Construct outer panels of G90 galvanized steel and inner panels of G90 galvanized steel.
 - 4. A sound baffle shall be secured to the inner liner of all fan sections and constructed of G90 galvanized perforated steel filled with 3 lb. per cu ft. density, neoprene coated, glass fiber insulation.
 - 5. Casing Air Pressure Performance Requirements:
 - a. Able to withstand up to 8 in-wc positive or negative static pressure.
 - b. The casing leakage rate shall not exceed 0.5 CFM per square foot of cabinet area at 6 inches of negative static pressure or 5 inches of positive static pressure.
 - c. Not to exceed 0.0042 inches per inch deflection at 1.5 times design static pressure up to a maximum of plus 8 in-wc in positive pressure sections and minus 8 in-wc in negative pressure sections.
 - d. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Module to module assembly shall be accomplished with an overlapping, full perimeter, insulated, internal splice joint sealed with bulb type gasketing on both mating modules.
 - 6. Manufacturer shall provide shipping splits in the air handler casing as required for moving the unit into the building through existing openings. The contractor shall verify the maximum section size to fit through existing openings. If any the unit sections are too large to fit, they shall be disassembled enough to move the equipment through the opening and then reassembled in the mechanical space.
- C. Access Doors:
 - 1. Construction, thermal and air pressure performance same as casing.
 - 2. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and handle assembly.
 - 3. Door shall swing outward for unit sections under negative pressure, or inward for unit sections under positive pressure.
 - 4. Door gaskets shall be bulb-type W shaped.
 - 5. All access doors shall be a minimum of 16" wide.
 - 6. Provide surface mounted handles on hinged, swing doors.
- D. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

- E. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.
- F. Insulation:
 - 1. Provide minimum thermal thickness of 13 R throughout.
 - 2. Completely fill panel cavities in each direction to prevent voids and settling.
 - 3. Comply with NFPA 90A.
- G. Drain Pan Construction:
 - 1. Provide cooling coil and humidifier sections with an insulated, double wall, stainless steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
 - 2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
 - 3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
 - 4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping. Drain connection centerline shall be above the base rail.
 - 5. Provide drain pans under all cooling coil, humidifier and heat recovery sections.
 - 6. Provide full 2" thickness of insulation under drain pan. Drain pans shall have a minimum height of 2" at the side.
- H. Finish:
 - 1. Indoor Units:
 - a. Provide exterior, galvanized steel panels.
 - b. Color: Manufacturer's standard color.

3.03 FAN SECTION

- A. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.
- C. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports.
- D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing near access door.
- E. All fan motors shall be premium efficiency. All motors of air handlers requiring variable frequency drives shall be provided with a shaft grounding system as required to prevent shaft current damage. This system shall be factory installed and shall be documented in maintenance manual. Manual shall include information on installation and maintenance of system with parts list and vendor name and address.
- F. Mounting:
 - 1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
 - 2. Factory mount motor on slide rails.
 - 3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.
- G. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.
- H. Fan Accessories:
- I. Fan Arrays:
 - 1. The fan array system shall consist of multiple, direct driven, plenum fans constructed per AMCA requirements for the duty specified, Class II or class III as required. All fans shall

be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan array shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed. All motors shall include isolated bearings or shaft grounding. Each fan/motor cartridge shall be dynamically balanced. All fan and motor assemblies shall be balanced in three orthogonal planes.

2. The fan array shall be provided with acoustical silencers that reduce the bare fan discharge sound power levels. The fan array shall consist of multiple fans and motors, spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air way tunnel cross section and components contained therein. Each fan cube shall be individually wired to a control panel. The fan array shall produce a uniform air flow profile and velocity profile within the airway tunnel of the air handling unit. Each fan & motor assembly shall be removable through a 24" wide, free area, access door located on the discharge side of the fan wall array. Maximum motor size of each individual fan shall be 5 Hp.
3. Each unit shall contain an electrical control center consisting of a surface mounted NEMA enclosure that shall include supply fan motor disconnect, overload protection and current sensor, one for each fan motor in multiple fan arrays. Individual MSP's for each fan shall be provided with a means for monitoring fan/motor status, and for interface with the fan array controller. The AHU unit shall be completely factory-wired, requiring only field wiring of main power wiring to the line side of the main power disconnect switch. The supplier/mechanical contractor shall be responsible for providing all wiring inside the air handler as well as installation of the electrical control center mounted on the outside of the unit (regardless of whether that gets mounted in the factory or on-site). Factory shall supply supports for VFDs that are provided by ATC.
4. Each fan array shall have a VFD panel supplied by the air handling unit manufacturer.
 - a. Provide a separate VFD for each fan in the array. All VFD's shall be mounted in the AHU fan control cabinet.
5. Provide backdraft gravity dampers for each fan in array.
 - a. Each fan applied in multiple fan applications shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan, or multiple fans, becomes disabled. The system effect for the submitted back flow prevention device shall be included in the calculation to determine the fan TSP for fan selection purposes, and shall be indicated as a separate line item SP loss in the submitted fan selection data.
 - b. Motorized dampers or other motorized devices submitted for back flow prevention are not acceptable.

J. Drives:

1. Comply with AMCA 99.
2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9 L-10 life at 50,000 hours.
3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
4. V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Variable and adjustable pitch sheaves selected so required RPM is obtained with sheaves set at mid-position and rated based on motor horsepower.
5. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

3.04 COIL SECTION

- A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
- B. Drain Pans: 24 inch downstream of coil and down spouts for cooling coil banks more than one coil high.
- C. Eliminators: Three break of Type 304 stainless steel, mounted over drain pan.
- D. Air Coils:
 - 1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.
 - 2. Drain and vent connections shall be provided exterior to unit casing.
- E. Fabrication:
 - 1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
 - 2. Fins: Aluminum.
 - 3. Casing: Die formed channel frame of galvanized steel.
- F. Water Heating Coils:
 - 1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
 - 2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
 - 3. Heating coils shall have a maximum of 10 fins per inch.
- G. Water Cooling Coils:
 - 1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
 - 2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.
 - 3. Cooling coils shall have a maximum of 9 fins per inch.

3.05 FILTER AND AIR CLEANER SECTION

- A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass. Filter media efficiency shall be as scheduled with flat or angle arrangement as shown on the drawings.
- B. Contractor shall install a set of filters in each air handler when the unit is installed. Filters shall be replaced with new before turning the building over to the owner.
- C. Pleated Media Filters:
 - 1. Media: 2 inch, 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
 - 2. Frame: Steel wire grid.
 - 3. Minimum Efficiency Reporting Value: MERV 13 when tested in accordance with ASHRAE Std 52.2.
 - 4. See Section 23 4000.
- D. Differential Pressure Gauge:
 - 1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
 - 2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.
 - 3. Provide across each filter section a differential pressure gauge with 4" dial and +/-2% full scale accuracy. Gauge(s) shall be similar to Dwyer Model #2001 (0" to 1") and Dwyer

Model #2002 (0" to 2"). Provide all necessary copper or aluminum tubing and mounting hardware to install gauge(s).

3.06 DAMPER SECTION

- A. Damper Blades:
 - 1. Double-skin low-leak, airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on each blade.
 - 2. Self-lubricating stainless steel or synthetic sleeve bearings. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided.
 - 3. Comply with ASHRAE Std 90.1 I-P for rated maximum leakage rate.
 - 4. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods. Damper leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential.
 - 5. Arrange in parallel or opposed-blade configuration.

3.07 VARIABLE FREQUENCY DRIVE

- A. Refer to section 23 0913 - Instruments and Control Elements on requirements for variable frequency drives.

PART 3 EXECUTION

4.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Bolt sections together with gaskets.
- C. Provide fixed sheaves required for final air balance.
- D. Make connections to coils with unions or flanges.
- E. Hydronic Coils:
 - 1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
 - 2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
 - 3. Locate water supply at bottom of supply header and return water connection at top.
 - 4. Provide manual air vents at high points complete with stop valve.
 - 5. Ensure water coils are drainable and provide drain connection at low points.
- F. All mechanical equipment shall be lubricated. All equipment shall be operated for a period of sufficient duration to insure its proper mechanical operation.
- G. Any changing of pulley sizes if found necessary when testing systems, shall be done by this contractor. Any additional dampers which may be found necessary to get proper air supply and quantity shall be furnished by this contractor at no expense to the Owner.

4.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Coordination of Other Tests and Inspections:
 - 1. Owner will employ independent Testing, Adjusting, and Balancing agency to test and/or inspect modular central-station air handling-unit.
 - 2. Provide access and _____ as required to accommodate timely performance.
 - 3. See Section 23 0593.

4.03 SYSTEM STARTUP

- A. Provide manufacturer's field representative to perform systems startup.

- B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.
- C. Adjust for proper operation within manufacturer's published tolerances.
- D. Manufacturer representative shall warrant the parts and labor of the equipment for 12 months from the date of start-up.

4.04 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's training personnel.

END OF SECTION

SECTION 23 8200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic finned tube radiation.
- B. Hydronic unit heaters.
- C. Hydronic cabinet unit heaters.
- D. Fan-coil units.

1.02 REFERENCE STANDARDS

- A. AHRI 440 - Performance Rating of Room Fan-Coils; 2008.
- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - 2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
 - 3. Submit 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, and comparison of specified heat required to actual heat output provided.
- C. Closeout Documents:
 - 1. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
 - 2. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
 - 3. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
 - 4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 6000 - Product Requirements for additional provisions.
 - b. Extra Filters: Two sets of each type and size.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 HYDRONIC FINNED TUBE RADIATION

- A. Manufacturers:
 - 1. Modine Manufacturing Company: www.modineHVAC.com.
 - 2. Sterling Hydronics, a Mestek Company: www.sterlingheat.com.

3. Vulcan Radiator, a Mestek Company: www.vulcanrad.com.
 4. Zehnder Rittling: www.rittling.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Required Directory Listing: AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.
 - C. Hydronic Heating Elements: 1 inch ID seamless copper tubing, mechanically expanded into evenly spaced aluminum fins sized for capacity indicated, suitable for soldered fittings. One or two row as scheduled. the length of the finned element as scheduled shall be provided and not reduced in length based on the scheduled heating capacity.
 - D. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
 - E. Enclosures: 18 gauge, 0.0478 inch sheet steel up to 18 inches in height, 16 gauge, 0.0598 inch sheet steel over 18 inches in height or aluminum as detailed, with easily jointed components for wall to wall installation.
 1. Mounting strips constructed of not less than 20 gauge steel shall support enclosure and position enclosure brackets.
 2. Enclosure joints shall be made and accessories shall be installed without visible fasteners. They shall lock into the mounting strip and to adjacent cabinets or other components to insure a perfect fit without cutting
 3. Enclosures shown short-of-wall installations shall have end panels.
 - F. Finish: Factory applied baked enamel of color as selected.
 - G. Damper: Where not thermostatically controlled, provide knob-operated internal damper at enclosure air outlet.
 - H. Access Doors: For otherwise inaccessible valves, provide factory-made permanently hinged access doors, 6 by 7 inch minimum size, integral with cabinet.
 - I. Fin radiation installed behind cabinet work shall be furnished less cover.

2.02 HYDRONIC UNIT HEATERS

- A. Manufacturers:
 1. Modine Manufacturing Company: www.modineHVAC.com/#sle.
 2. Rittling. www.zehnder-rittling.com
 3. Sterling Hydronics, a Mestek Company: www.sterlingheat.com.
 4. Vulcan. www.vulcanrad.com
 5. Trane Technologies, PLC; _____: www.trane.com/#sle.
 6. Daikin.
- B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.
- C. Perform factory run test under normal operating conditions, water, and steam flow rates.
- D. Casing: Minimum 18 gauge, 0.0478 inch thick sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 18 gauge, 0.0478 inch thick sheet steel top and bottom plates for vertical projection models.
- E. Finish: Factory applied baked enamel of standard color as selected.
- F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- G. Air Outlet: Adjustable pattern diffuser on vertical projection models and two way louvers on horizontal projection models.
- H. Control: Room thermostat specified elsewhere in the specifications.

2.03 HYDRONIC CABINET UNIT HEATERS

- A. Manufacturers:
 - 1. Modine Manufacturing Company: www.modineHVAC.com/#sle.
 - 2. Rittling. www.zehnder-rittling.com
 - 3. Sterling Hydronics a Mestek Company: www.sterlingheat.com.
 - 4. Vulcan. www.vulcanrad.com
 - 5. Trane Technologies, PLC; _____: www.trane.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Coils:
 - 1. Evenly spaced aluminum fins mechanically bonded to copper tubes.
- C. Cabinet: Minimum 16 gage, 0.0598 inch thick sheet steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, The inlet of any floor mounted units shall be a minimum of 4" above finished floor.. Unit shall be ceiling hung, recessed, semi-recessed, inverted flow, floor mounted or wall hung as scheduled. Recessed units shall be provided with 2" overlapping front cabinet on four sides for installation in wall above floor.
- D. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.
- E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- F. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted with built-in thermal overload protection.
- G. Control: Factory wired, solid state, infinite speed control, located in cabinet. Ceiling mounted units shall be provided with flush type speed control switch for remote wall mounting.
- H. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.
- I. Controls:
 - 1. Room thermostat equal to Room thermostat specified elsewhere in the specifications.

2.04 FAN-COIL UNITS

- A. Manufacturers:
 - 1. Vertical Cabinet:
 - a. Daikin Applied: www.daikinapplied.com.
 - b. Dunham Bush <https://www.dbamericas.com>
 - c. Trane, a brand of Ingersoll Rand: www.trane.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Performance Data and Safety Requirements:
 - 1. Unit capacities certified in accordance with AHRI 440.
 - 2. Insulation to comply with NFPA 90A requirements for flame spread and smoke generation.
 - 3. Equipment wiring to comply with requirements of NFPA 70.
 - 4. All units shall be quiet operating at high speed.
- C. Required Directory Listings: AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI).
- D. Coils:
 - 1. Units shall be four pipe and shall have combination heating and cooling. A stainless steel drain pan shall be provided beneath coil(s) and an extension or secondary drain pan shall be provided beneath the control valve and connections. The drain pan shall be equipped with a secondary drain pipe connection and a condensate overflow switch to automatically shut down the unit upon high water detection.
 - 2. Evenly spaced aluminum fins mechanically bonded to copper tubes.
 - 3. Water Coil: Suitable for working temperatures not less than 200 degrees F.

- 4. Provide drain pan under cooling coil easily removable for cleaning.
- E. Finish: Exposed units shall have factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.
- F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted. Three-speed switches shall have "Off" position.
- H. Controls:
 - 1. Ceiling hung units shall be furnished with remote speed control switch.
 - 2. Provide units with control valves furnished by the fan coil unit manufacturer.
- I. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil. Provide two (2) extra filters at the end of the job.
- J. Floor mounted units shall have inlet a minimum of 4 inches above the finished floor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Finned Tube Radiation:
 - 1. Locate on outside walls and run cover continuously wall-to-wall unless otherwise indicated.
 - 2. Center elements under window with elements of equal length centered under each window for multiple windows.
 - 3. Install wall angles and end caps where units butt against walls.
 - 4. Align cabinet joints with window mullions.
 - 5. Coordinate finned tube mounting height with architect and architectural elevations.
- B. Unit Heaters:
 - 1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
 - 2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
 - 3. If structure is more than six feet above unit, support off wall bracket or provide lateral bracing.
 - 4. In wood construction, provide spring isolation hangers and flexible pipe connections.
- C. Cabinet Unit Heaters:
 - 1. Coordinate installation with architect.
 - 2. Coordinate to ensure correct recess size for recessed units.
- D. Fan-Coil Units:
 - 1. Install as indicated.
 - 2. Coordinate to ensure correct recess size for recessed units.

3.02 CLEANING

- A. Vacuum clean coils and inside of units.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

END OF SECTION

SECTION 23 8300 - RADIANT HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic radiant panel heaters.
- B. Radiant heating hydronic piping.

1.02 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. ASHRAE Std 138 - Method of Testing for Rating Ceiling Panels for Sensible Heating and Cooling; 2021.
- C. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.
- D. DIN 14037-2 - Free hanging heating and cooling surfaces for water with a temperature below 120 Degrees C - Part 2: Pre-fabricated ceiling mounted radiant panels for space heating - Test method for thermal output; 2016.
- E. DIN 14037-3 - Ceiling Mounted Radiant Panels Supplied with Water at a Temperature Below 120 Degrees C; Part 3: Rating Method and Evaluation of Radiant Thermal Output; 2016.

1.03 SUBMITTALS

- A. See Division 01 – Administrative Requirements, for submittal procedures.
- B. Shop drawings:
 - 1. Materials and layout.
 - 2. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.
 - 3. Samples: The subcontractor shall submit a ceiling radiant panel sample to Architect for approval before installing any radiant ceilings.
- C. Closeout Documents:
 - 1. Project Record Documents: Record actual locations of ceiling panel heaters.
 - 2. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, installation instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 HYDRONIC RADIANT PANEL HEATERS

- A. Manufacturers:
 - 1. Aero Tech
 - 2. Air Tex
 - 3. Airtite
 - 4. TWA
 - 5. Sigma
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Modular Radiant Ceiling Panels: Heat sinks located behind panel, transfer heat between copper tubes and panel face, and radiate heat to zone.
 - 1. Performance:
 - a. The radiant-acoustical panels shall produce a minimum heating output of 135 BTU per hours per sq. ft. at 165° F mean water temperature (M. W. T.) in a room with 79°F

air temperature, 70°F average unheated surface temperature, medium construction of roof above, and natural air motion. Panels installed in exterior zone spaces with sunlight glass shall produce a minimum absorption rate of 45 BTU per hour per sq. ft. at a M. W. T. of 19.5°F below room temperature of 78°F, when 25% of the wall is glass.

2. Modular configuration:
 - a. Frame type: Lay-in
 - b. Basis of design - Airtex Radiant Modulpanels
 - c. Size: 24" x 48" x 0.40" thick.
 - d. Insulation: 3/4 lb. density glass fiber pads, Gustin-Bacon Ultralite 75, or equal
3. Linear Configuration:
 - a. Frame type: Lay-in
 - b. Basis of design - Airtex Radiant Linear Extruded
 - c. Size: see schedule
 - d. Insulation: 3/4 lb. density glass fiber pads, Gustin-Bacon Ultralite 75, or equal
4. Water Tubes:
 - a. ASTM B75/B75M copper tubing, 1/2 inch minimum nominal diameter.
 - b. Water Connections:
 - 1) Suitable for solder or compression fittings.
 - 2) Protect with removable seals. Prevent introduction of dirt and dust during shipping.
5. Heat Sink Construction:
 - a. Mechanically fasten extruded aluminum and copper pipe to heat sink.
 - b. Provide non-hardening heat transfer paste between tubing, heat sink, and panel.
6. Panel Face: Construct of minimum 18 gauge, 0.0403 inch thick aluminum.
7. Finish:
 - a. Panels shall be block perforated and silk screened to match ceiling.
 - b. Color: As selected by Engineer from manufacturer's standard range.
 - c. Maintain optimal radiative properties, durability, and cleanability.
8. Water Pressure Drop and Heating Output Data: Derive from factory testing in accordance with ASHRAE Std 138 or DIN 14037, Parts 2 and 3.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Hydronic Radiant Ceiling Panel Heaters:
 1. Install level and plumb.
 2. Suspend from structure.
 3. Support in grid-type suspended ceiling using grid as support element as follows:
 - a. Install a minimum of four ceiling support system rods or wires for each panel, located not more than 6 inches from panel corners.
 - b. Fasten support clips to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
 - c. Install at least one independent support rod or wire from structure to tab on panel with breaking strength of the weight of panel at a safety factor of 3.
 4. Unless otherwise indicated, install shutoff valve and union or flange at each connection.
 5. Provide tamper-proof, balancing valve with memory stop on return piping.
 6. Provide float operated automatic air vents with stop valve.
 7. Circuiting of panels shall be such as to limit pressure loss across the individual controlled panel zone to 10 feet W.C., or less.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Hydronic Radiant Ceiling Panel Heaters:
 - 1. Inspect for damage to finish.
 - 2. Repair damaged finish to match original finish.
 - 3. Perform the following field tests, inspections, and prepare test reports:
 - a. Leak Test:
 - 1) After installation, fill water tubes, and test for leaks.
 - 2) Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 - c. Test and adjust controls and safeties.
 - 4. Remove and replace damaged and malfunctioning controls and equipment and retest as specified above.

3.04 CLEANING

- A. Radiant Ceiling Panel Heaters: Remove paint splatters, other spots, dirt, and debris.
 - 1. Radiant Panels are prone to permanent staining from fingerprints. Contractor to ensure panel remains clean during installation and or degrease at final turnover.

END OF SECTION

SECTION 26 0000 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical General Requirements specifically applicable to Division 26 Sections, in addition to Division 01 - General Requirements.
- B. Definitions common to Division 26 specification sections.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 26.
- B. This section is related to all other sections of Division 26.

1.03 DEFINITIONS

- A. Words "Architect" where written in Division 26 specifications and drawings refer to commissioned Design Professional, whose name appears on contract documents.
- B. Word "Engineer" where written in Division 26 specifications and drawings refers to Consulting Electrical Engineer, CMTA, 2201 12th St. N. , Suite E, Fargo, ND, 58102; phone (701)280-0500, facsimile (701)280-0522.
- C. Word "Contractor" where written in Division 26 specifications and drawings refers to Electrical Contractor and any and all of his subcontractors.
- D. Word "Material" where written in Division 26 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.
- E. Word "Medium Voltage" where written in Division 26 specifications and drawings shall mean 1,000 to 72,500 volts (IEEE).
- F. Word "Labor" where written in Division 26 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.
- G. Word "Low Voltage" where written in Division 26 specifications and drawings shall mean 0 to 1,000 Volts (IEEE).
- H. Word "Provide" where written in Division 26 specifications and drawings shall mean "Electrical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".
- I. Performance Verification Testing refers to test performed in the field to ensure proper operation and / or installation of service or products.
 - 1. Unless noted otherwise Performance Verification Testing is not required to be provided by a 3rd party testing firm.
 - 2. Unless noted otherwise Performance Verification Testing is not required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent
- J. Acceptance Testing refers to formal testing process required prior to acceptance by the Owner.
 - 1. Unless noted otherwise Acceptance Testing is required to be provided by a 3rd party testing firm.
 - 2. Unless noted otherwise Acceptance Testing is required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent.
- K. As-built drawings are prepared by the contractor. They show, in red ink, on-site changes to the original construction documents.

- L. Record drawings are prepared by the Architect or Engineer and reflect on-site changes the contractor noted in the as-built drawings.
- M. Quality Assurance includes all the planned and systematic activities implemented that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality. Typically, quality assurance procedures are performed before and while the work is being performed. As such in the Division 26 specifications Quality Assurance procedures are specified in Part 1.
- N. Quality Control includes all the planned activities required to verify quality after the work has been performed. This can include testing and inspections along with other procedures. As such in the Division 26 specifications Quality Assurance procedures are specified in Part 3.
- O. Furnish: Under this Contract, Contractor shall deliver to the site item(s) specified, as well as additional specialized materials and/or accessories necessary for the use and operation of item or items specified.
- P. Install: Under this Contract, Contractor shall set in position, connect (including sub-assemblies furnished), and adjust for use. Contractor shall furnish miscellaneous specialty items such as fittings, hangers, fastening devices, etc., as obviously necessary for a complete and operating installation.
- Q. Provide: Under this Contract, Contractor shall furnish and install item or items specified. Contractor shall perform all labor and furnish all materials and equipment necessary to that specified item or system will be complete and operational in every respect.

1.04 SCOPE OF WORK

- A. All Specifications, corresponding Drawings and all Addenda form a complete set of documents for electrical work for this project, and no part shall be considered complete without the other.
- B. The Specifications, Drawings, and all Addenda describe both the design characteristics and functional performance criteria that the completed electrical and telecommunications and electronic safety and security systems shall include.
- C. Contractor shall obtain all required licenses, permits, plan reviews, inspections and pay all fees, costs and all other charges for this project. All sales, use and any other taxes shall be paid by Contractor.
- D. Electrical Work shall comply with all ordinances, laws, regulations and codes applicable to the work involved. If, in any instance, the plans and specifications conflict with such laws, the stricter requirement shall take preference.
- E. If Contractor is aware of conflicts between drawings or specifications and such codes or regulations, they shall be brought to the Engineer's attention prior to commencing work. If Contractor performs work in violation of such codes or regulations, Contractor shall correct the violation at his expense.
- F. Work under Division 26 includes providing all labor and materials necessary for satisfactory completion of all electrical work shown on all drawings and in all specification divisions. In general, this consists of the following:
 - 1. Luminaires and lighting control systems and devices.
 - 2. Low Voltage Power Distribution.
 - 3. Wiring devices.
 - 4. Other systems specified, indicated, or shown.
- G. Site Investigation
 - 1. Prior to submitting bids, visit the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.
 - 2. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions.

3. Where work under this project requires extension, relocation, or modifications to existing equipment, systems or installations the existing equipment, system or installations shall be restored to their original condition, with exception to the work under this project, before completion.
4. Existing equipment, systems and installations which are not detailed on the drawings must still be restored to their original condition.

1.05 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement (contract).
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates: See Division 00 and Division 01.

1.06 DRAWINGS

- A. Drawings indicate the extent and general layout of the electrical systems.
- B. The electrical drawings are diagrammatic (that is, designed to demonstrate or explain the scope of work), they are intended to be as accurate as planning can determine.
- C. The scales are shown for estimating purposes only. Field verification of dimensions, locations, and construction details is required. Review appropriate drawings (for example: shop drawings), make field measurements and adjust work to suit the conditions encountered. Although electrical drawings are diagrammatic, they shall be followed as closely as actual construction permits.
- D. Contractor shall coordinate with civil, architectural, structural, and mechanical construction drawings for locations of partitions, walls, beams, shafts, equipment, etc.
- E. Standard electrical symbols along with special symbols are used on all drawings.
- F. In general, the drawings of the Electrical Systems and Equipment are to scale, however, to determine exact locations of walls and partitions, the Contractor shall consult the Architectural and/or Structural Drawings which are dimensioned. Drawings shall not take precedence over field measurements. Plans showing circuiting or conduit routing, although shown on scale drawings, are diagrammatic only. They are intended to indicate the size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail or exact arrangement of construction.
- G. If it is found before installation of any or all construction phases, that a more convenient, suitable or workable arrangement of any or all phases of the project would result by varying or altering the arrangement indicated on the drawings, the Engineer may require any or all Contractors to change the location or arrangement of their work without additional cost to the Owner. Such rearrangement shall be in accordance with directions from the Engineer.
- H. Where discrepancies are discovered after certain portions or phases of any Contract have been installed, the Engineer reserves the right to have the Contractor make minor changes in conduit or duct, outlet, fixture or equipment locations or arrangements to avoid conflict with other work at no additional cost to the Owner. It shall be the responsibility of the contractor to provide written notification to the Engineer prior to making any changes or performing any additional work described in the plans and specifications. The Contractor may not be compensated for work done before notifying the Engineer.
- I. Because the drawings are to a relatively small scale to show as large a portion as is practical, the fact that only certain features of the system are indicated does not mean that other similar or different features or details will not be required. The Contractor shall furnish all incidental labor, materials, or equipment for the systems under their control, so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the Specifications.

- J. The Contractor shall be responsible for determining all field measurements before commencing construction, giving due consideration to building design and other equipment to be installed. Electrical equipment not dimensioned on the drawings shall be field located, giving due consideration to the work of other trades and the intent of use and function for the building or space. The Contractor shall verify all dimensions before proceeding with the work. Where cutting and patching is required, each Subcontractor shall be responsible for their own work, unless otherwise determined by the Contractor.
- K. Dimensions shall not be scaled from the drawings. If the Contractor discovers any discrepancy between actual measurements and those shown on the drawings which prevents good practice, good arrangement, or which is contrary to the intent of the drawings and specifications, he shall notify the Engineer before proceeding with the work.

1.07 REGULATORY REQUIREMENTS

- A. Work provided shall comply with the following partial list of governing codes and regulations:
 - 1. International Building Code (IBC).
 - 2. International Fire Code. (IFC).
 - 3. State Fire Codes.
 - 4. State and Local Electric Codes.
 - 5. State Building Code.
 - 6. Serving Utility Regulations.
 - 7. National Fire Protection Association (NFPA) National Fire Codes.
 - a. NFPA 70 - National Electrical Code.
 - b. NFPA 72 - National Fire Alarm and Signaling Code.
 - c. NFPA 101 - Life Safety Code.
 - 8. Williams-Steiger (OSHA) Regulations.
 - 9. Americans with Disabilities Act (ADA) requirements.

1.08 QUALITY ASSURANCE

- A. Notify the Architect or Engineer of any discrepancies in or omissions from the drawings and documents. Interpretations and clarifications during bidding will be made only by written Addenda. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality, and appropriate adjustment will be made after contract award.
- B. Any work not clear to Contractor shall be referred to Architect or Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work, in question, as directed by Architect or Engineer, whose decision shall be final, without additional charges.
- C. By virtue of submitting a bid, Contractor agrees that he is skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that he has carefully reviewed all drawings, all specifications and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.
- D. Should major changes from drawings and specification be necessary, Contractor shall provide notification and secure written approval and agreement concerning such changes before work is started.

1.09 SITE INSPECTION

- A. Before submitting a proposal for the Work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize himself with all the existing conditions and limitations, including the extent of demolition, cutting and patching to be done by the Subcontractor for Electrical Work. No extras will be allowed because of the Contractor's misunderstanding as to the amount of work involved, or their lack of knowledge of any condition in connection with the Work.

1.10 WARRANTY

- A. The Electrical Contractor shall guarantee that all materials and equipment included in their work free of defects caused by flawed workmanship, material or equipment failures.
- B. The warranty guarantee shall extend one year minimum from the date of final acceptance of the work or for as long as normal equipment manufacturer warranties are in effect from the date of final acceptance of the work.
- C. During the warranty period, the Electrical Contractor shall respond by making appropriate corrections or repairs required to correct defect within one week of notification. Notification shall be made by telephone, fax, email, or letter.
- D. The Electrical Contractor shall provide 24-hour service in case of emergency.

1.11 INSPECTIONS AND FEES

- A. The Contractor shall obtain all permits and licenses required in connection with the work under Division 26, 27 and 28. Cost for such shall be paid by the Contractor.
- B. When application for utility service is the Owner's responsibility, the Contractor shall be responsible for all phases of the installation other than the application itself and shall coordinate the utility's work with their installation.

1.12 ALLOWANCES

- A. Material and labor allowances are indicated in specification sections 26 0519, 26 0533, 26 2726.
- B. The material and labor allowances listed indicate quantities of material to be installed. They do not indicate associated installation labor, tools, overhead or profit which shall be the Contractor's responsibility to include in base bid along with the cost of the noted materials, no adjustments to the Contract will be allowed for such expenses.

1.13 SUBSTITUTIONS

- A. Where substitute materials or prior approved materials are provided, Contractor shall assume all responsibility and pay for all necessary changes resulting from such substitution. This responsibility shall also include any extra costs required by other trades.
- B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for equipment which meet or exceed the specifications included herein.
- C. When a product is considered discontinued by the manufacturer, an equal or better product shall be used instead of the discontinued product, pending approval by the Engineer.
- D. Required where specifically noted or where materials are specifically identified by a manufacturer's name, model or catalog number. In these cases only such material may be included in base bid. Prior approval of substitute materials shall be required.
- E. Prior approved substitutions:
 - 1. Requests for prior approval shall be made in accordance with Division 01, as specified below, and indicated in specific specification section.
 - 2. If Contractor desires to furnish materials other than that named, Contractor or supplier shall apply in writing, to Architect, for prior approval of such material at least ten (10) days prior to bid opening date.
 - 3. Requests for prior approved substitution shall indicate specific proposed materials in lieu of those specified together with complete technical data for all such proposed material.
 - 4. All prior approved substitutions will be clearly identified in addenda which will be sent to all bidders well in advance of bid opening. Only material listed on drawings, specifications and addenda shall be provided.

- F. Substitutions after execution of contract: Substitution of materials other than those specifically named in contract documents will be approved, by Architect or Engineer, for following reason only:
 - 1. That material proposed for substitution is equal to or superior, in Engineer and Architect's opinion, to that specified in construction, efficiency, appearance, and utility.
 - 2. That material named in the documents cannot be delivered to project in time to complete work due to conditions beyond control of Contractor.
- G. Equal To and Or Equal: Where materials are specifically identified as "equal to" an identified manufacturer's name, model, or catalogue numbers or where noted as "or equal" manufacturer's complying with the requirements of these specifications not listed may be incorporated in the Work. Such materials must be equal to or superior, in Engineer's opinion, to that specified in construction, efficiency, appearance, and utility.

1.14 GENERAL REQUIREMENTS FOR SUBMITTALS

- A. Submit according to the requirements of Division 01.
- B. General requirements for Submittals for Review
 - 1. Submittal format, general information, and requirements for all submittals:
 - a. At the front of the submittal on a dedicated page(s): name, address, and phone number of equipment vendor, engineer, and contractor.
 - b. At the front of the submittal on dedicated page(s): Any deviation from contract requirements shall be called to attention. No deviation will be permitted without written approval of Architect or Engineer.
 - c. At the front of the submittal on dedicated page(s): Any requests for clarification, selections that must be made, etc. shall be called to attention.
 - d. At the front of the submittal on a dedicated page(s): Include a complete list of equipment included with manufacturer and model number or catalog number.
 - e. Submittals shall be grouped to include complete information for related systems, products, and accessories in a single submittal with tabs, dividers, or other means of separating each different component within the submittal from the next.
 - f. Mark dimensions and values in units to match those specified.
 - g. Drawings and brochures shall be clearly marked as to item to be supplied and shall have designation corresponding to designation on Drawings (for example: enclosed switch data shall indicate for which equipment they are provided).
 - 2. Contractor Review of Submittals
 - a. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to issuing submittal. Each submittal set shall be stamped, signed and dated indicating Contractor review. If the Contractor fails to properly review submittals, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.
 - b. Should the contractor fail to comply with any of the requirements of the specified submittal requirements; then the right is reserved by the Architect or Engineer to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect and / or Engineer, shall be used in the work at no additional cost to the Owner.
 - 3. Architect / Engineer Review of Submittals
 - a. The submittal will be reviewed with reasonable promptness, and returned to the Contractor (with copies retained by the Engineer and the Architect). No equipment should be released for shipment until submittals have been approved.
 - b. Submittal review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers

of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required.

c. Approval Stamp: Submittals will be reviewed with the following actions noted:

- 1) "No Exception Taken" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation.
- 2) "Reviewed as Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
- 3) "Revise and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at his discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
- 4) "Rejected" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required and fabrication or procurement is not authorized.

4. If the Architect or Engineer rejects (Revise and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews (beyond the first two) at a rate of \$500 per review. Compensation will be incorporated by Change Order and will be deducted from the Contractor's application for payment. Contractor is responsible for all delays caused by the resubmittal process

C. General Requirements for Submittals For Information

1. Information submittals shall include the information noted in the specifications and information requested by the Architect, Engineer, and / or Owner.
2. Coordination Drawings: Where this and other specification sections require Coordination Drawings to be submitted meet the requirements defined in Division 01 and as indicated below.
 - a. Prepare documents using software program required by Division 01. If no requirements are listed utilize a software compatible with AutoDesk's AutoCAD.
 - b. Submit hardcopies and / or electronic copies as required by Division 01. Drawings and files shall be uniquely labeled.
 - c. Scale shall not be less than 1/8" equal 1 foot.

D. General Requirements for Submittals for Closeout:

1. As specified in Division 01 and Section 26 0100.

E. General Requirements for Product Data. The following are minimum requirements.

1. Catalog sheets showing ratings, settings, performance curves and rated capacities.
2. Dimensions, knockout sizes and locations, materials, fabrication details, finish.
3. Outline and support point dimensions, voltage, ampacity, integrated short circuit ampere rating, arrangement and sizes, roughing-in data, and accessories.
4. Operational Characteristics.

F. General Requirements for Shop Drawings. The following are minimum requirements.

1. Electrical ratings of equipment; how the components of the equipment are assembled and function together; and how they will be installed on the project.
2. Dimensioned plans, elevations, sections, and details. Show quantities of installed devices, features, and ratings.
3. Detail enclosure types.
4. Detail configuration, current, and voltage ratings.

5. Detail features, characteristics, ratings, and factory settings devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
- G. General Requirements for Manufacturer's Instructions. The following are minimum requirements.
 1. Application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.
 2. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
 3. Instructions for placing each piece of equipment and system into operation.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 JOB INSPECTION

- A. Periodic job site observations will be made throughout the construction to review applications for payment, observe methods and materials of construction, and review requirements of the Bid Documents.
- B. Contractor shall notify the Engineer, or authority having jurisdiction, and arrange for observation of installation prior to backfill or concealing of systems. Contractor shall, to the maximum practical extent, schedule work to allow for the observation of systems' installation in groups rather than individually.
- C. Upon completion of all work, and submittal and approval of Test Reports, Maintenance Manuals and Record Drawings, Contractor shall notify the A/E and shall make arrangements for a Substantial Completion inspection.
- D. After the inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement or completion.
- E. The Contractor shall promptly comply completely with all the listed requirements. Should the Contractor fail to perform promptly, the Engineer reserves the right to have the work completed by others and the cost deducted from the contract price.
- F. The Contractor will be billed for projects which are not complete enough for a Substantial Completion Report (Punch List) by the Engineer when one is previously scheduled.

3.02 NOT USED.

END OF SECTION

SECTION 26 0100 - ELECTRICAL SYSTEMS CLOSE OUT DOCUMENTATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Operations and Maintenance Manuals.
- B. Warranty Documentation.
- C. Maintenance Materials.
- D. As-Built Drawings.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 26.
- B. This section is related to all other sections of Division 26.

1.03 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Division 01 and Section - Electrical General Requirements.
- B. Provide operations and maintenance manuals and As-Built drawings.

1.04 SUBMITTALS FOR CLOSEOUT

- A. Provide all documents as described below and in each specification section according to the requirements of Division 01 upon reaching substantial completion of the project unless noted otherwise.

PART 2 PRODUCTS

2.01 OPERATIONS AND MAINTENANCE MANUALS

- A. Bind operations and maintenance manual for electrical system in a hard-back binder (Provide 2 copies).
- B. In addition to the bound copies listed above, provide all O&M material in digital format (.pdf) on a single flash drive of sufficient size for all documents. Systems and materials shall be bookmarked and separated in folders similarly to the bound documents.
- C. Provide dedicated manuals for the following:
 - 1. Division 26 systems and equipment unless noted otherwise.
 - 2. Division 26 lighting and lighting control.
 - 3. Division 26 low voltage generator and transfer equipment.
- D. Common Results for Operation and Maintenance Manuals. The following information shall apply to all manuals.
 - 1. Provide a master index at the beginning of manual indicating items included.
 - 2. The first section of each manual shall list the name, address, and phone number of Architect, Electrical Engineer, Contractor, and all associated Subcontractors.
 - 3. Each section shall include an approved and edited copy of submittals for review with review comments.
 - 4. Warranty information shall be provided with each piece and / or type of equipment include Manufacturer's Warranty Statement.
 - 5. Testing Reports shall comply with the requirements of section - Testing of Electrical Systems.
- E. Front cover of each binder shall have the following lettering done in silk screen:
 - 1. ***NAME OF SYSTEM***

2. OPERATION AND MAINTENANCE MANUAL FOR (PROJECT NAME, PROJECT LOCATION)
- F. The Division 26 systems and equipment manual shall include the following sections (when applicable) with dividers between each section and tabs to separate each device with each divided section. See the applicable sections of the Division 26 specifications for additional information.
1. Branch Circuit Panelboards.
 2. Enclosed Switches and Circuit Breakers.
 3. Shunt Trip Elevator Switch.
 4. Enclosed Motor Controllers.
 5. Instrumentation.
 6. Wiring devices.
 7. Surge protective devices.
 8. Receipts for Spare Materials, Owner Training / Demonstrations.
 9. Test Reports and Certificates.
 10. Operation and Maintenance Guidelines.
 11. Contractor's Warranty Statement according to the requirements of specification "Electrical General Requirements."
- G. The Division 26 Lighting and lighting control manual shall include the following sections with dividers between each section and tabs to separate each device with each divided section. See the applicable sections of the Division 26 specifications for additional information.
1. Luminaires (including specific lamp and ballast information).
 2. Lighting control devices.
 3. Lighting control systems. Include electronic copies of final system programming as well as hard copies.
 4. Receipts for Spare Materials, Owner Training / Demonstrations.
 5. Test Reports and Certificates.
 6. Operation and Maintenance Guidelines.
 7. Contractor's Warranty Statement according to the requirements of specification "Electrical General Requirements."
- H. The Division 26 low voltage generator and transfer equipment manual shall include the following sections with dividers between each section and tabs to separate each device with each divided section. See the applicable sections of the Division 26 specifications for additional information.
1. Circuit Breakers and accessories (lifting mechanism, racking tools, etc.)
 2. Automatic transfer switch product data and control wiring diagrams.
 3. Test Reports and Certificates.
 4. Operation and Maintenance Guidelines.
 5. Manufacturer's warranty statements.
 6. Contractor's Warranty Statement according to the requirements of specification "Electrical General Requirements."

2.02 AS-BUILT DRAWINGS

- A. The contractor shall maintain one set of drawings at the job site to be used as a master copy. All changes and deviations shall be clearly marked and noted by colored pencil. These drawings shall be turned over to the Architect upon project completion.
- B. As-Built Drawings shall include the following information in addition to specific information indicated in individual specification sections:
1. Actual locations / configurations of components and circuits.
 2. Indication of route of all feeders and branch circuits 100-amps and larger.

3. Indicate route and location of all underground circuits, raceways, pull boxes, etc.
4. Indicate actual locations and mounting heights of outlet boxes, pull boxes, junction boxes, surface metal raceway, and wireway.
5. Final locations of all lighting control devices and diagrams showing circuiting / control wiring arrangements.
6. Provide table indicating final setting of all automatic lighting control sensors.
7. Provide document indicating final programming of relay panel.
8. Panel and Switchboard Directories: Provide revised typed directories with As-Built documents.
9. If aluminum conductors are installed as allowed by Section - Low Voltage Electrical Conductors and Cables, the As-Built drawings shall indicate which feeders / branch circuits are aluminum and a revised typed feeder / branch circuit schedule shall be provided indicating conductor and conduit sizes.

C. Indicate other information specifically noted in other Division 26 specification sections.

2.03 MAINTENANCE MATERIALS

- A. Turn over to owner and obtain signed receipt for all maintenance materials, spare parts, touched up parts and loose items.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope general construction materials and methods for application with electrical, communications, and electronic safety and security systems installations.
- B. Materials specified herein include:
 - 1. Concrete.
 - 2. Miscellaneous for support of electrical materials and equipment.
 - 3. Hangers and Supports.
 - 4. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in walls, floors, ceilings, roofs, foundations for moisture, water, smoke, fire and acoustic control.
- C. General electric construction methods and requirements specified herein include:
 - 1. Material and workmanship.
 - 2. Product manufacturer requirements.
 - 3. Coordination.
 - 4. Safety.
 - 5. Material handling, storage protection, cleaning and painting.
 - 6. Cutting, patching and finishing.
 - 7. Penetrations.
 - 8. Wiring Methods.
 - 9. Balancing Loads.
 - 10. System Interruptions.
 - 11. Outlet mounting heights.
 - 12. Electrical demolition and remodeling.
 - 13. Equipment Wiring (connections).
 - 14. Coordination with Utility Company for permanent electric service. Utility Company charges for service shall be paid directly by the Owner.
- D. Owner Instruction and Demonstration.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 26.
- B. This section is related to all other sections of Division 26.
- C. Division 03 Section Cast-in-Place Concrete (Miscellaneous Cast-in-Place Concrete).
- D. Section 26 01 00 Electrical Systems Close Out Documentation.

1.03 ELECTRIC SERVICE DESCRIPTION

- A. Serving Utility Company: Verify
- B. System Characteristics: As indicated on drawings.

1.04 REGULATORY REQUIREMENTS

- A. See Section 26 0000.

1.05 COMMON REQUIREMENTS FOR QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.
- B. Installer Qualifications: Engage experienced Installers for Work.

- C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide UL Labeled and listed access door assembly with flush door, frame, hinge, and latch from manufacturer listing in the UL "Building Materials Directory" for rating shown.
- D. Standardization of Product Manufacturer:
1. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.
 2. Except as noted, all switchboard, panelboards, safety switches, and equipment or wiring cabinets shall be manufactured by the same company, all finishes shall be the same color, and all equipment shall fit the space designated.
 3. Except as noted, all magnetic starters, manual starters and motor control centers shall be manufactured by the same company, all finishes shall be the same color, and all equipment shall fit the space designated.
 4. Wiring devices and other items covered under a single specification section, with the exception of light fixtures, shall be of the same manufacturer and style whenever practical or where failure to do so is visibly noticeable.
- E. Material and Workmanship:
1. All materials provided shall be new and shall be approved by the Underwriters Laboratories, Inc., NFPA, NEMA, and ANSI as conforming to its standards in every case where such a standard has been established for such material.
 2. Materials shall be standard products of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.
 3. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
 4. All workmanship shall be neat and complete in both effectiveness and appearance and shall be executed by persons licensed and skilled in the trade. Engineer reserves the right to reject any material or workmanship before, during or after construction.
 5. Materials and Finishes: Provide adequate corrosion resistance to eliminate staining of exposed surfaces.
 6. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- F. Coordination:
1. See also "Quality Assurance" paragraph of Section 26 0000.
 2. Discrepancies and omissions discovered during construction shall immediately be called to the attention of the Architect or Engineer for clarification.
 3. Installation of materials shall be coordinated with other trades and installed at such time and manner as to not delay or interfere with the work of other trades.
 4. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections. Determine connection locations and requirements.
 5. Sequence and coordinate work with other trades so as to avoid conflict of space and time sequence. If interference develops, the matter shall be brought to the attention of the Architect for decision.
 6. Organize the work so that progress of work will conform to the progress of other trades. Give particular attention to large equipment requiring positioning prior to closing the building.
 7. Complete the entire installation as soon as building conditions permit.
 8. This Contractor shall be held solely responsible for coordinating proper size and location of hangers, slots, chases, openings, etc., required for proper installation of his work and shall arrange with the proper building contractors for inserts, chases, and openings.

9. Refer to drawings and specifications of all other divisions and trades for correlating information, location and details of work, dimensions, etc. Coordinate location of all outlets and equipment. If conflicts develop Architect or Engineer's decision will govern. No additional compensation will be allowed for moving of un-coordinated, misplaced or poorly located outlets, material, equipment or work.
 10. The Contractor shall coordinate locations and arrangements of their equipment with other Contractors and Subcontractors working on the project. Before starting work, the Contractor shall examine the Architectural, Structural and Electrical drawings and specifications, as well as shop and vendor drawings, for all divisions, to ascertain locations, levels, arrangements and dimensions of other work and shall confer and cooperate with all other Contractors or Subcontractors to avoid all interferences. They shall also provide Subcontractors for other trades with information regarding locations, arrangements and dimensions of their equipment. They shall also coordinate their own cutting and patching requirements with those of other Subcontractors, so that it will not be necessary for any Subcontractor to remove or re-do work improperly scheduled.
 11. In cases of interferences between various items of equipment or between equipment and building members, if simplified construction is made possible by the relocation of certain equipment, changes in arrangements may be made, but only if authorized by the A/E.
 12. Interferences between the work of different divisions which cannot be resolved by the parties involved shall be submitted to the Engineer who shall decide upon final location and arrangement without respect to which work was installed first.
- G. Pre-installation meetings are required as noted in this and other specification sections and are intended to help coordination efforts. Electrical Contractor shall schedule and convene a pre-installation meeting with all affected trades as noted in specifications and on Drawings.
 - H. Provide competent representative(s) on site constantly to supervise work from beginning through completion and final acceptance. So far as possible contractor shall keep same foreman and workmen throughout project duration.
 - I. During its progress, the work shall be subject to observation by representatives of Owner, Architect and Engineer at which times Contractor shall furnish all required information and cooperation

1.06 SAFETY

- A. Comply with the requirements of Division 01 and this specification.
- B. Perform work in accordance with NFPA 70E and in compliance with OSHA requirements.
- C. Do not perform work on exposed live electrical equipment. If work is required (as defined by OSHA 29 CFR 1910.333) to be performed on exposed live electrical equipment an energized work permit must be must be prepared (see NFPA 70E for energized work permit requirements) and a Hazard/Risk Analysis in accordance with NFPA 70E and provide appropriate levels of personal protective equipment according to NFPA 70E.
- D. Only Qualified Persons as defined by NFPA 70E shall be allowed to work on exposed live electrical equipment. Observe the safety boundaries defined in NFPA 70E.
- E. Prior to performing work on exposed live electrical equipment convene a safety meeting to address safety hazards specific to the task.
- F. Safety Program: the electrical contractor shall implement and document an electrical safety program in accordance with NFPA 70E and a workplace safety program that complies with the requirements OSHA and NFPA 70E.

1.07 SUBMITTALS FOR REVIEW

- A. Submit according to the requirements of Division 01 and Section 26 0100.
- B. Provide manufacturers installation instructions and product data for:
 1. Sleeves.

1.08 SUBMITTALS FOR INFORMATION

- A. Submit according to requirements of Division 01 and Section - Electrical General Requirements.
- B. Submit written requests for System Interruptions and Outages as specified herein.
- C. Submit Utility Company prepared drawings two weeks prior to commencing electric service work.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Manufacturers
 - a. RACO.
 - b. Appelton
 - c. Caddy
 - d. B-Line
 - e. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements.
 - 2. Concrete Structural Elements: Use precast insert system, expansion anchors, powder actuated anchors and preset inserts.
 - 3. Steel Structural Elements: Use beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 4. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 5. Hollow Masonry and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 6. Solid Masonry Walls: Use expansion anchors and preset inserts.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.
- B. Steel Channel:
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.
 - b. Unistrut®.
 - c. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements.
 - 2. Description:
 - a. Hot dip galvanized where located outdoors and in wet/damp locations.
 - b. Painted steel indoors in dry locations.
 - c. Paint cut ends of channel in damp locations.
 - d. Stainless steel or nonmetallic channel as shown on plans.
- C. Powder Activated Anchors: Remington. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements.
- D. Spring Steel Clips:
 - 1. Caddy
 - 2. Steel City
 - 3. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements
- E. Miscellaneous Metals:
 - 1. Steel plates, shapes, bars, and bar grating: ASTM A 36.
 - 2. Cold-Formed Steel Tubing: ASTM A 500.
 - 3. Hot-Rolled Steel Tubing: ASTM A 501.
 - 4. Steel Pipe: ASTM A 53, Schedule 40, welded.

5. Nonshrink, Nonmetallic Grout: Premixed, factory-packed, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
 6. Fasteners: Zinc-coated, type, grade, and class as required.
- F. Miscellaneous Lumber:
1. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
 2. Construction Panels: Plywood backboards; APA A-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 3/4 inches.

2.02 JOINT SEALERS

- A. General: Joint sealers, joint fill material, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Project engineer from manufacturer's standard colors.
- C. Provide fire resistant joint sealers as specified in Division 07.
- D. Fire-Resistant Joint Sealers: One-part or two-part, foamed-in-place, sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, ducts and through penetrations through fire-rated walls, ceilings, roofs and floors. Sealants and accessories shall have required fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.03 SLEEVES

- A. Sleeves for Raceways and Cables
 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized Steel.
 2. Rectangular Sleeves: Galvanized Sheet Steel. 16 Gauge for less than 50 square inches and not side longer than 16 inches. 8 gauge for greater than 16 inches or one side more than 16 inches.
- B. Sleeve Seals
 1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Link Seal.
 3. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 4. Pressure Plates: Carbon steel. Include two for each sealing element.
 5. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element
 6. Provide fire rated seals as required. See Division 07.

2.04 CONCRETE

- A. Switchboards, motor control centers and dry type transformers shall be mounted on 3-1/2" high concrete pads furnished by this contractor. Size pads such that pad extends 2" beyond the perimeter of the equipment installed.

- B. Poles provided for mounting exterior light fixtures shall be installed on or in concrete bases provided by the electrical contractor as detailed on drawings.
- C. Exterior pad-mounted transformers, generators and CT Cabinets shall be mounted on concrete pads furnished by this Contractor. Pads shall be sized as required by Utility, size of equipment being installed or as detailed on drawings. Size pads such that pad extends 6" beyond the perimeter of transformers and CT cabinets and 12" for generators.
- D. Concrete shall conform to Division 03 of this specification.

2.05 EQUIPMENT

- A. All equipment shall be new and in first-class condition. Equipment shall not be used for purposes other than intended by the manufacturer.
- B. Manufacturer's nameplate, name or trademark shall be permanently affixed to all equipment and material furnished under this Specification. Nameplate of Subcontractor or distributor will not be acceptable. Nameplate shall be masked prior to any painting. Remove masking after completion.
- C. Equipment specified and furnished shall be of a type and manufacturer that has a local representative and a local replacement and service outlet to give complete coverage on parts and service at all times.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR EXAMINATION PRIOR TO ELECTRICAL INSTALLATIONS

- A. Verify conditions and constructions types prior to installation.
- B. Verify that surfaces that support Product(s) are ready to receive them.
- C. Examine location of equipment installation for compliance with installation tolerances and other conditions affecting performance of Work
 - 1. Prepare drawings showing proposed rearrangement of work to meet Project conditions, including changes to work specified in other Divisions. Obtain permission of Architect before proceeding.
- D. Review all Drawings including architectural, mechanical, structural, civil, and electrical drawings for extent of Work.
 - 1. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
- E. Examine Architectural drawings and elevations to verify device locations and mounting heights.
 - 1. In finished spaces, where mounting heights are not detailed or dimensioned coordinate mounting height with Architect.
 - 2. Do not rough-in for any wall mounted equipment without verifying mounting height with Architect unless equipment is specifically noted on Architectural Drawings.
 - 3. Do not scale dimensions from Electrical Drawings and verify all mounting heights noted on Electrical Drawings.
 - 4. See preparation, quality assurance, and coordination requirements in section Raceways and Boxes for Electrical Systems for additional information and requirements.
- F. Site Investigation
 - 1. Prior to beginning work, exam the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.
 - 2. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions prior to beginning work.
 - 3. Existing equipment, systems and installations whether or not they are not detailed on the drawings must be restored to their original condition.

3.02 COMMON REQUIREMENTS FOR PREPARATION TO INSTALLATION

- A. Equipment Wiring preparation
 - 1. Obtain and review shop drawings, product catalog data, etc. prior to roughing-in for electrical connections.
 - 2. Verify dimensions and final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - 3. Refer to equipment drawings and specifications in all specification Divisions for rough-in requirements.
- B. Electric Utility Service Entrance preparation
 - 1. Coordinate location of Utility Company's facilities to ensure proper access is available.
 - 2. Provide compression lugs on end of service entrance cable to be terminated at the Utility Company's transformer as required by Utility Company.
 - 3. Verify that field measurements are as indicated on Utility Company drawings.
 - 4. Pre-Installation meeting: Convene two weeks prior to commencing work of this section with Utility Company representative, General Contractor, and other trades affected by site work to coordinate final location of transformer and underground electrical Work.
- C. Demolition and remodeling preparation.
 - 1. Notify the Owner and Architect at least five (5) days prior to commencing demolition operations
 - 2. Demolition Drawings are based on field observation and existing record documents. Report discrepancies to Architect before disturbing existing installation.
 - 3. Verify existing circuiting arrangements and control apparatus and wiring.
 - 4. Verify that abandoned wiring and equipment serve only abandoned facilities.
 - 5. Review existing equipment and materials with the Owner, schedule or indicate equipment to be salvaged for re-use and equipment to be salvaged and turned over to the Owner.
 - 6. Beginning of demolition means Contractor accepts existing conditions.
 - 7. Extension of existing circuits and or systems: Prior to connecting any new Work to existing circuits or systems Contractor shall provide field measurements and surveys required to ensure adequate capacity is available for new connections.
- D. Hangers and Supports preparation
 - 1. Coordinate the installation of required supporting devices, inserts and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Strength of construction shall not be impaired.
 - 2. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations. Strength of construction shall not be impaired.
 - 3. Provide plywood backboards for mounting of all electrical panelboards, transfer switches, disconnects, and other similar electrical equipment. Plywood shall be primed and painted with (2) coats of Gray enamel prior to mounting any equipment, wiring, etc

3.03 COMMON INSTALLATION REQUIREMENTS FOR ELECTRICAL WORK

- A. Description Of Wiring Methods:
 - 1. All wiring shall be installed in accordance with applicable codes and as noted in section 26 0519, unless otherwise indicated.
 - 2. Multi-wire branch circuits shall not be allowed unless specifically noted. Provide separate neutral conductor for each circuit.
 - 3. See Section Low Voltage Electrical Power Conductors and Cables for conductor and cable requirements.
 - 4. See Section Raceways and Boxes for Electrical Systems for box and raceway requirements.
- B. Install products in accordance with manufacturer's instructions and industry best practices.

- C. Install work in locations shown on drawings, unless prevented by Project conditions. Refer to architectural drawings for exact devices locations.
- D. Conform to arrangements indicated by Contract Documents, recognizing that the Work is shown only in diagrammatic form.
- E. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- F. Install materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- G. Core drilling of concrete is required, where possible, in lieu of hammer drilling. Hammer drilling is generally to be limited to small holes for anchors.
- H. Install access door assembly where units are concealed behind finished surfaces. Access doors are specified in Division 08 and this section.
- I. Hangers and Supports
 - 1. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
 - 2. Do not fasten supports to pipes, ducts, mechanical equipment and conduit. Do not drill or cut structural members.
 - 3. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
 - 4. Install surface-mounted cabinets, disconnects, contactors, starters and panelboards with minimum of four anchors.
 - 5. In wet and damp locations use steel channel supports to stand cabinets, disconnects, contactors, starters and panel boards approximately one inch off wall.
- J. Floor, Wall And Ceiling Penetrations
 - 1. Effectively seal penetrations in exterior walls, roofs, and rated interior walls in accordance with Division 07.
 - 2. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access door units. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 3. Conduits and cables passing through floors, walls, and ceilings at the following locations shall be sealed for the purpose of sound, heat, smoke and / or moisture control.
 - a. Acoustically rated walls.
 - b. Fire and / or smoke resistant walls and floors.
 - c. All electrical rooms.
 - d. All mechanical rooms.
 - e. Penthouse.
 - f. All exterior walls.
 - g. All vertical and horizontal shafts.
 - h. All walls around janitor rooms, receiving rooms, and other facility maintenance and management rooms.
 - i. Food service areas.
 - j. Medical exam, procedure, and consultation rooms.
 - 4. Where conduits and raceways pass through interior walls and ceilings (not requiring water proofing) provide suitable sealing material complying with Division 07 for the wall construction; examples:
 - a. Plaster for plaster walls.
 - b. Joint compound for gypsum board walls.
 - c. Mortar for masonry block and brick walls.

- d. Grout for concrete walls.
 - 5. Place sealing material around each conduit and raceway for the full thickness of the wall.
 - 6. Where conduits and raceways pass through exterior walls and ceilings below grade, provide installation to meet the details noted on the Drawings.
 - 7. Where interior walls require waterproof conduit and raceway seals, provide silicone sealant generally installed as specified above for exterior walls.
 - 8. Where conduits and raceways pass through exterior walls above grade, provide matching wall material inside (see examples above) and provide waterproof seal of silicone sealant or other approved sealant on outside.
 - 9. At the nearest point of access to wires (inside conduit or raceway) passing through exterior walls and roof; provide "Ductseal" between wires and conduit or raceway as a wind barrier.
 - 10. Where cables pass through walls, ceilings and floors, generally use same sealing method as for conduits.
 - 11. "Ductseal" type material is generally not acceptable except as noted above.
 - 12. Utilize fire rated cabling pathways where cabling must be routed through fire-rated floor and wall assemblies.
- K. Roof Penetrations
- 1. Electrical Contractor shall be responsible for providing roof seals for each raceway, mast, tower leg, guy wire, etc., which pass through roof, rest on roof or attach to roof. Avoid roof penetrations where possible. This work shall be performed by the Roofing Contractor. Electrical Contractor shall coordinate work as needed.
- L. Cutting, Patching, and Finishing
- 1. General: Perform cutting, patching and finishing in accordance with Division 01.
 - a. Cut, remove, and legally dispose of material including but not limited to construction material, and other indicated material made obsolete by the new work.
 - b. Protect the structure, furnishings, finishes, and adjacent materials and installations not indicated or scheduled to be cut or removed.
 - c. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt into adjacent areas.
 - d. The Contractor shall not endanger the stability of the structure by cutting, excavation or otherwise.
 - e. Do not cut or alter work of any other trade without trade and Architect / Engineer's consent.
 - 2. Perform cutting, patching and finishing of walls, floors, ceilings, roofs required to:
 - a. Uncover work to provide for installation of new or ill-timed work.
 - b. Remove and replace defective work.
 - c. Remove samples of installed work as specified for testing.
 - 3. Upon written instructions from the Architect / Engineer, uncover and restore work to provide for Engineer's observation of concealed work.
 - 4. Should any cutting be required for proper installation of electrical work because of failure to give the General Contractor the proper information at the time required, such cutting shall be done at the Electrical Contractors expense.
- M. Equipment wiring installation
- 1. Provide all necessary boxes, raceways, and wiring required to make equipment and systems complete and operable.
 - 2. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.
 - 3. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components.
 - 4. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

5. Make electrical connections in accordance with equipment manufacturer's instructions.
6. Make conduit connections to equipment using flexible metal conduit. Use liquidtight flexible metal conduit with watertight connectors in damp or wet locations.
7. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
8. Provide suitable receptacle outlet to accommodate connection with attachment plug.
9. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
10. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
11. Install terminal block jumpers to complete equipment wiring requirements.
12. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.04 DEMOLITION AND REMODELING

- A. General Demolition:
 1. Remove, relocate, and extend existing installations to accommodate new construction.
 2. Where indicated or required, remove existing electrical systems in walls, floors, and ceilings scheduled for removal.
 3. Where abandoned wiring serves equipment and / or facilities not indicated to be removed Contractor shall extend and / or reroute wiring to maintain service to the equipment that shall remain.
 4. Repair adjacent construction and finishes damaged during demolition and extension work.
 5. Maintain access to existing electrical installations which remain active. Modify installation or provide access door unit as appropriate.
- B. Raceway and Box Demolition:
 1. Remove all abandoned conduit, unless indicated to remain for re-use or future work, including abandoned conduit exposed during demolition and located above accessible ceilings.
 2. Cut concealed abandoned conduit flush with walls and floors that are indicated to remain.
 3. Remove abandoned boxes if conduit servicing them is removed.
 4. Provide appropriate blank cover for abandoned boxes which are not removed.
 5. Disconnect and remove abandoned panelboards and distribution equipment as indicated.
- C. Conductor and Cabling Demolition:
 1. Remove all abandoned conductors and cabling in their entirety.
- D. Equipment Demolition:
 1. Where indicated or required, remove all luminaires, stems, brackets, hangers, supports, etc.
 2. Remove, demount, and disconnect existing electrical materials and equipment indicated to be salvaged, and deliver same to the location designated for storage. Leave in good condition and store in orderly manner.
 3. Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- E. Maintain existing systems in service until new systems are complete and ready for use.
 1. Disable existing systems only to make switchovers and connections.
 2. Notify Architect, Construction Manager, and Owner and obtain permission before partially or completely disabling systems.
 3. Minimize outage duration and coordinate time with Owner at his convenience.
 4. Make temporary connections to maintain service, feeders and branch circuits when outage time exceeds 8 hours or more.

3.05 ELECTRIC UTILITY SERVICE

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Coordinate location of Utility Company's facilities to ensure proper access is available.
- C. Provide compression lugs on end of service entrance cable to be terminated at the Utility Company's transformer as required by Utility Company.
- D. Verify that field measurements are as indicated on Utility Company drawings.
- E. Pre-Installation meeting: Convene two weeks prior to commencing work of this section with Utility Company representative, General Contractor, and other trades affected by site work to coordinate final location of transformer and underground electrical Work.
- F. Underground Service Entrance
 - 1. Install conduits on high voltage side of pad mounted utility transformer as per Utility Company or as shown on drawings.
 - 2. Install service entrance conduits and conductors from Utility Company's pad-mounted transformer to CT cabinet and then to building service entrance equipment. Unless noted otherwise, Electrical Contractor shall furnish lugs and connect service entrance conductors to pad transformers.
 - 3. Verify size, depth and other requirements with Utility. Utility to terminate cables in CT cabinet and provide CT and metering wiring.
- G. In addition to his own investigations, the Contractor is encouraged to call the following marking services prior to digging for any underground work:
 - 1. Minnesota - 1-800-252-1166 (Gopher one call)

3.06 INTERRUPTIONS, ENERGIZATIONS, AND OUTAGES

- A. Coordinate utility service outages and disconnections with Utility Company.
- B. Provide temporary wiring, connections, and protection as required to maintain all existing systems to remain in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Owner approval is required prior to electric service outages or energizations and shall be scheduled at the convenience of the Owner.
 - 1. A written request must be submitted to the Owner / Architect / Engineer for approval a minimum of 15 days prior to outage or energization.
 - 2. Cancellation of the planned interruption by the Owner for any reason, at any time up to 24 hours before planned interruption shall bear no additional cost to the Owner.
- D. Major Feeder and Service Work Sequence: A minimum of 10 days before the requested outage, submit a schedule of proposed electric feeder and switchboard outages and energizations.
 - 1. Include construction energizations and work performed during other than normal working hours (outside of 7:00 am to 6:00 pm Monday through Friday).
 - 2. Include details of the work to be completed during each outage.
- E. Minimize outage time and provide manpower such that work can be carried out at multiple locations if required.
- F. Outages and / or energizations may require the Contractor to work at other than regular normal working hours. No extra compensation will be allowed for such times.

3.07 EQUIPMENT AND DEVICE MOUNTING HEIGHTS

- A. Coordinate final mounting heights as directed under Part 3 paragraph "Preparation".
- B. Interior mounting heights indicated on drawings are from finished floors (interior) or final grade (exterior). Mounting heights for items indicated on exterior walls are from the interior finished floor below.

- C. Mounting heights indicated are to the top of the device plate unless noted otherwise. Mounting heights are nominal and shall be adjusted to fit block joints.
- D. Typical mounting heights are detailed on the Drawings.
- E. Handicapped counter and lavatory locations: meet ADA requirements for receptacle and switch locations and elevations.
- F. Contractor shall verify mounting heights of all outlets to assure installation above top of radiation covers, mirrors, counters, vanity, cabinets, and any other obstruction that may alter indicated mounting heights. ADA accessible controls must be mounted at 48".

3.08 TEMPORARY FACILITIES

- A. The Contractor shall provide temporary facilities according to Division 01, "TEMPORARY FACILITIES".
- B. Temporary power shall consist of Power Distribution Centers (PDC).
 - 1. All equipment shall be grounded per the National Electrical Code, 2020 Edition, NFPA 70.
 - 2. Relocate equipment as necessary to allow construction to continue.
 - 3. Provide GFI protection as required by OSHA. Use GFI receptacles in lieu of circuit breakers whenever possible.
 - 4. Welders, temporary heat-blowers, etc. shall be hardwired as needed.
- C. Provide temporary lighting with local switching that provides adequate illumination for construction operations as follows:
 - 1. Provide a suitable quantity of fixtures to achieve a continuous light level of 15 footcandles for all interior access routes throughout the buildings and in stairwells. Additional temporary lighting shall be provided in mechanical rooms, electrical rooms, kitchens, and rooms over 1000 square feet. Temporary task lighting in individual rooms is the responsibility of individual contractors.
 - 2. Relocate lighting as required to allow construction to continue.
- D. Under no condition shall permanent lighting fixtures or electric heating units be used for temporary lighting or heat, unless approved in writing by Engineer.
- E. Temporary lighting and power systems shall be approved by authority having jurisdiction.

3.09 OWNER INSTRUCTION AND DEMONSTRATION

- A. Complete operating instructions composed of charts, diagrams, installation instructions, service instructions and wiring diagrams, shall be mounted in a conspicuous location on or immediately adjacent to the equipment concerned. Charts shall be in a glass or approved plastic-enclosed case.
- B. Contractor shall instruct the Owner's personnel in the operation and maintenance procedures of all equipment and systems. Contractor shall confirm in writing prior to the final inspection that Owner has been instructed to their satisfaction in the operation of all systems. Coordinate with the Owner.
- C. The Contractor shall obtain and maintain a list of all attendee in attendance at all training sessions. This list shall be submitted to the Engineer.
- D. Additional requirements shall be listed in some sections of this specification.
- E. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment and operation of all parts of the electrical equipment to the Owner's employees who are to have charge of the equipment. Including but not limited to the following:
 - 1. Demonstrate the proper operation of systems per the operational and function requirements of the Contract Documents and as outlined in any sequence of operation.
 - 2. Instruct personnel, in all phases of operation, location of components and use of all systems.

3. Review manufacturer Warranty information for all equipment included in the manual.
- F. Number of hours of instruction shall be specified in other sections of this specification.
- G. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- H. Owner instruction / demonstration shall be provided as noted below and as noted in specification sections (see individual specification section for additional requirements):
 1. Low Voltage Electrical Conductors and Cables - indicate manufacturer's recommendations for tightening and checking bolted connections.
 2. Grounding and Bonding - review building grounding and bonding systems.
 3. Identification for Electrical Systems - review naming conventions, color schemes, warning labels, posted operating instructions, bolted connection labels, etc.
 4. Lighting Control Devices - see specification section.
 5. Electrical Distribution Equipment - provide overview of system, highlight major components and distribution equipment. Review suggested maintenance schedules.
 6. Wiring Devices - review maintenance requirements (e.g. GFCI monthly test requirements).
 7. Packaged Engine Generator Set - see specification section.
 8. Enclosed Transfer Switches - see specification section.
 9. Surge Protective Devices - review locations, alarm indicating lights, and maintenance procedures to follow alarms are indicated.
 10. Lighting Fixtures and Luminaires - review lamp changing requirements for all fixture types.
 11. Fire Alarm System - review modifications to existing system.
- I. Documentation: Upon completion of Owner Instruction and Demonstration provide a certificate signed and dated by the attendees indicating information covered, amount of instruction / demonstration time provided, and applicable specification sections. Provide certificate for all Owner Instruction and Demonstration sessions. Include copy with O & M Manual. A sample certificate is attached for reference.

3.10 FIELD QUALITY CONTROL

- A. So far as possible contractor shall keep same foreman and workmen throughout project duration. Keep enough workmen on job to insure keeping up with or ahead of other trades so that no delays occur.
- B. Delivery, Storage, and Handling
 1. Deliver, store, protect and handle products on site under provisions of Division 01 according to manufacturer's recommendations and as specified herein.
 2. This Contractor shall make provisions for delivery and safe storage of materials.
 3. Accept Products on site. Inspect for damage
 4. Protect Products from corrosion and entrance of debris. Provide appropriate covering. During construction, it shall be the responsibility of this Contractor to protect the surface of equipment and material furnished.
 5. See individual specifications sections for specific delivery, storage, handling and protection requirements.

3.11 CLEAN-UP, KEY CONTROL, AND PAINTING

- A. Remove all packing materials, rubbish, debris, etc. from the site each day.
- B. String all furnished keys on split metal key ring and turn same over to Owner at project completion.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Variable-frequency drive cable.
- D. Wiring connectors.

1.02 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- H. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.
- I. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
- J. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 79 - Electrical Standard for Industrial Machinery; 2024.
- M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- R. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- S. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops
- T. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.
- U. UL 2277 - Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

1.07 MATERIAL AND LABOR ALLOWANCE

- A. The Electrical Contractor shall provide the following as directed by the Architect during Construction. The cost for all labor, materials, overhead, profit, taxes and other incidental charges shall be included in the base bid. If such items are not required the Owner shall have the right to take possession or a deduct may be applied to the contract.
 1. Provide 3000 feet of #10AWG copper conductor.

PART 2 PRODUCTS

2.01 DESCRIPTION OF SYSTEM

- A. Conductor and conduit sizes noted are based on type THHN copper unless noted otherwise.
- B. Conductor material applications:
 1. Motor Feeders: Copper. Aluminum Conductors are not acceptable.
 2. Feeders for panelboards, switchboards, and other distribution equipment: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. It is the responsibility of the contractor to provide wire and conduit of equal ampacity to the copper conductors shown unless specific Aluminum wire and conduit sizes are indicated.
 3. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
 - a. Use stranded conductors for control circuits.
 - b. Use conductor not smaller than 12 AWG for power and lighting circuits.
 - c. Use conductor not smaller than 16 AWG for control circuits.
 - d. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 60 feet.
 - e. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 145 feet.
- C. Wiring Methods
 1. See Section 26 0533 for raceway system requirements.
 2. Service Entrance: Type THHN-THWN single conductors in raceway or Type XHHW-2, single conductors in raceway.
 3. Feeders for panelboards, switchboards, and other distribution equipment: Type THHN-THWN or XHHW-2 single conductors in raceway.
 4. Motor Feeders: Type THHN-THWN or XHHW-2 single conductors in raceway.

5. Branch Circuits:
 - a. Multi-wire branch circuits shall not be acceptable. Provide dedicated neutral conductor for each circuit.
 - b. Home Runs (from circuit breaker to junction box at accessible location adjacent to first wiring device): Type THHN-THWN single conductors in raceway.
 - c. Exposed (including in crawl spaces, electrical rooms, mechanical rooms, and above accessible ceilings): Type THHN-THWN single conductors in raceway.
 - d. Concealed (e.g. in ceilings, walls, partitions): Type THHN-THWN single conductors in raceway or multi-conductor cable Type MC.
 - 1) MC cable is generally permitted to installed concealed within walls or above non-accessible ceilings only. Limit exposed runs of MC cable above accessible ceilings to 8' and install parallel or perpendicular to building lines.
 - 2) All homeruns to be single conductors in raceway, and each homerun shall have a junction box installed above the accessible ceiling.
 - 3) Type MC cable shall not be installed where it is subject to physical damage.
 - e. Direct Burial (Outdoors): Direct buried cables are not acceptable.
6. Wiring for Variable Frequency Drives:
 - a. Input to the VFD: Copper, 600V, 90 degree C, THHN, THWN-2, XHHW2, RHH, or RHW-2. Single conductors in conduit.
 - b. Output from VFD to equipment: variable-frequency drive cable or type XHHW, 90 degree C, Single conductors in conduit.
7. Class 1 Control Circuits: Type THHN-THWN single conductors in raceway.
8. Class 2 Control Circuits:
 - a. For lighting control devices (occupancy sensors, low-voltage switches, etc.), exposed multi-conductor cable, plenum rated shall be acceptable in concealed locations. Install cabling in accordance with Section 27 0528.
 - b. Unless otherwise noted all other locations use type THHN-THWN single conductors in raceway.

2.02 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
 - b. Where concealed in hollow stud walls for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from paneboard to j-box in ceiling of each room fed by circuit.
 2. In addition to other applicable restrictions, may not be used:
 - a. Where not approved for use by the authority having jurisdiction.
 - b. Where exposed to view.
 - c. Where exposed to damage.
 - d. For damp, wet, or corrosive locations.
 - e. For isolated ground circuits.
 3. Metal-clad Luminary Cable is permitted only as follows:
 - a. Where not otherwise restricted, may be used:
 - 1) Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

D. CONDUCTOR AND CABLE GENERAL REQUIREMENTS

1. Provide products that comply with requirements of NFPA 70.
2. Provide products listed, classified, and labeled as suitable for the purpose intended.
3. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
4. Comply with NEMA WC 70.
5. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
6. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
7. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
8. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
9. Conductor Material:
 - a. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 1) Where aluminum conductors are substituted for copper, comply with the following:
 - (a) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
 - (b) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
 - (c) Provide aluminum equipment grounding conductor sized according to NFPA 70.
 - b. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - c. Tinned Copper Conductors: Comply with ASTM B33.
 - d. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
10. Minimum Conductor Size:
 - a. Branch Circuits: 12 AWG.
 - 1) Exceptions:
 - (a) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - (b) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
11. Conductor Color Coding:
 - a. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - b. Color Coding Method: Integrally colored insulation.
 - c. Color Code:
 - 1) 480Y/277 V, 3 Phase, 4 Wire System:
 - (a) Phase A: Brown.
 - (b) Phase B: Orange.
 - (c) Phase C: Yellow.
 - (d) Neutral/Grounded: Gray.
 - 2) 208Y/120 V, 3 Phase, 4 Wire System:
 - (a) Phase A: Black.

- (b) Phase B: Red.
 - (c) Phase C: Blue.
 - (d) Neutral/Grounded: White.
 - 3) Equipment Ground, All Systems: Green.
 - 4) Isolated Ground, All Systems: Green with yellow stripe.
 - 5) Travelers for 3-Way and 4-Way Switching: Pink.
 - 6) For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
 - 7) For control circuits, comply with manufacturer's recommended color code.
- E. SINGLE CONDUCTOR BUILDING WIRE
- 1. Description: Single conductor insulated wire.
 - 2. Conductor Stranding:
 - a. Feeders and Branch Circuits:
 - 1) Size 10 AWG and Smaller: Solid.
 - 2) Size 8 AWG and Larger: Stranded.
 - 3. Insulation Voltage Rating: 600 V.
 - 4. Insulation:
 - a. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, or type XHHW-2 where noted.
 - b. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.
- F. METAL-CLAD CABLE
- 1. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
 - 2. Conductor Stranding:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 - 3. Insulation Voltage Rating: 600 V.
 - 4. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
 - 5. Grounding: Full-size integral equipment grounding conductor.
 - 6. Armor: Steel, interlocked tape.
- G. VARIABLE-FREQUENCY DRIVE CABLE
- 1. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.
 - 2. Conductor Stranding: Stranded.
 - 3. Insulation Voltage Rating: 1000 V.
 - 4. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.
 - 5. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.
 - 6. Provide metallic shielding.
 - 7. Jacket: PVC or Chlorinated Polyethylene (CPE).
- H. WIRING CONNECTORS
- 1. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
 - 2. Connectors for Grounding and Bonding: Comply with Section 26 0526.
 - 3. Wiring Connectors for Splices and Taps:

- a. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - b. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
 - c. Connectors for Aluminum Conductors: Use compression connectors.
- 4. Wiring Connectors for Terminations:
 - a. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - b. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - c. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - d. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - e. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - f. Aluminum Conductors: Use compression connectors for all connections.
 - g. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - h. Conductors for Control Circuits: Use crimped terminals for all connections.
- 5. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- 6. Mechanical Connectors: Provide bolted type or set-screw type.
- 7. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- 8. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
- I. Re-usable / Re-enterable splices
 - Equal to Tyco GelCap SL.
 - Moisture sealant temperature rating -40 degrees C to 105 degrees C.
 - Clear cap to allow visual inspection.
 - Two ports accept wires from #14 to #2/0 AWG.
 - Single port accepts #14 to #6 AWG.
 - Reenterable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install metal-clad cable (Type MC) in accordance with NECA 120.
- F. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- I. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

- J. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.
- K. Install conductors with a minimum of 12 inches of slack at each outlet.
- L. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- O. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- P. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- Q. Insulate ends of spare conductors using vinyl insulating electrical tape.
- R. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- S. Identify conductors and cables in accordance with Section 26 0553.
- T. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- U. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- V. Connection of 0-10V fixtures: 0-10V dimming circuit shall not be run in same conduit as 120/277V connection for fixture.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.02 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2025.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Field quality control test reports.
- D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 - 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 - 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in

NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

- a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
- b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
- c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

G. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:

1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
11. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

J. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
- K. Cable Tray Systems: Also comply with Section 26 0536.
- L. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use mechanical connectors for connections to electrodes at ground access wells.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
- E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
 - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
 - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
- D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.
- E. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- F. Identify grounding and bonding system components in accordance with Section 26 0553.
- G. Communication and Electronic Safety and Security Systems Grounding
 - 1. Provide a #10 AWG equipment grounding conductor from the nearest grounding bus to the all communications equipment racks, cabinets, and enclosures.
 - 2. Provide a #10 AWG equipment grounding conductor from the nearest grounding bus to the cable tray system.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Reinforced thermosetting resin conduit (RTRC).
- I. Conduit fittings.

1.02 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2025.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- K. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.
- L. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015 (Reaffirmed 2021).
- M. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015 (Reaffirmed 2020).
- N. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015 (Reaffirmed 2021).
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- Q. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- R. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- S. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- T. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- U. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

- V. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.06 MATERIAL AND LABOR ALLOWANCE

- A. The Electrical Contractor shall provide the following as directed by the Architect during Construction. The cost for all labor, materials, overhead, profit, taxes and other incidental charges shall be included in the base bid. If such items are not required the Owner shall have the right to take possession or the contract may be modified.
- B. 1000 feet of ¾" EMT conduit along with all associated boxes, connectors, couplings, straps, and screws necessary for installation.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, electrical metallic tubing (EMT).
- C. Underground:
1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
 7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
- E. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Exposed, Exterior: Use electrical metallic tubing (EMT).
- L. Exposed, Exterior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
1. Maximum Length: 6 feet.
- N. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 3. Maximum Length: 6 feet unless otherwise indicated.
 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

2.02 CONDUIT REQUIREMENTS

- A. Communications Systems Conduits: Also comply with Section 27 1000.
- B. Fittings for Grounding and Bonding: Also comply with Section 26 0526.
- C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.

- E. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Communications conduits: 1" trade size minimum.
 - 4. Underground, Interior: 3/4 inch (21 mm) trade size.
 - 5. Underground, Exterior: 1 inch (27 mm) trade size.
- F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- C. PVC-Coated Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.08 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - 4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

- A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
- B. Supports: Per manufacturer's recommendations.
- C. Fittings: Same type and manufacturer as conduit to be connected.
 - 1. Cement-Tight Joints: Use bonded coupling or bell and spigot.
 - 2. Cement- and Water-Tight Joints: Use adhesive and manufacturer's standard gaskets.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Only RMC and IMC are permitted within 1.5" of roof decking.
- H. A cable, raceway or box, installed in exposed or concealed locations under roof decking, shall be installed more than 1.5 inches from the lowest point of the roof decking to the top of the cable, raceway or box.
- I. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal all conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 5. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
 - 9. Arrange conduit to provide no more than 150 feet between pull points.
 - 10. Route conduits above water and drain piping where possible.
 - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 - 14. Group parallel conduits in the same area together on a common rack.
- J. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 00 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.

6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
 9. Use of wire for support of conduits is not permitted.
- K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
 7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- M. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 2316 and Section 31 2323.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
- N. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
 2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
 3. Install conduits within middle one third of slab thickness.

4. Secure conduits to prevent floating or movement during pouring of concrete.
- O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
 4. Where conduits are subject to earth movement by settlement or frost.
 5. Any runs over 200 feet.
- P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- R. Provide grounding and bonding in accordance with Section 26 0526.
- S. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

END OF SECTION

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Floor boxes.
- D. Audio / Video or communication outlet boxes
- E. Recessed Backboxes for Monitor Locations.
- F. Recessed weatherproof boxes.
- G. Poke thru box assemblies.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 - 4. Use suitable concrete type boxes where flush-mounted in concrete.
 - 5. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 6. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 7. Use shallow boxes where required by the type of wall construction.
 - 8. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 13. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
 - 14. Wall Plates: Comply with Section 26 2726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Floor boxes for on grade applications:
 - a. Recessed Activation Four Compartment (Cast Iron or epoxy coated designed for on-grade applications)
 - 1) Manufacturer:
 - (a) Wiremold RFB4-OG (4 compartment)
 - (b) Approved equal.
 - 2) Description:
 - (a) Recessed cast iron box (or epoxy coated designed for on-grade applications); concealed multi-service.
 - (b) Four wiring compartments with 1" and 1¼" knockouts.
 - (c) Devices concealed in box below floor.
 - (d) Watertight, fully adjustable in concrete pour.
 - 3) Accessories provide as required:
 - (a) Duplex receptacle bracket.
 - (b) Duplex GFCI bracket.
 - (c) Modular Telephone/Data bracket with four RJ openings.
 - (d) Active adapter bracket: accepts two 2A size active adapters.
 - (e) Blank cover.
 - (f) Barrier kit.
 - 4) Devices:
 - (a) Quantities and type as indicated on Drawings.
 - (b) Devices as specified in Section 26 2726 - Wiring Devices
 - 5) Cover:
 - (a) Flanged without carpet/tile cutout.
 - (b) Flanged with furniture feed cover (allows 1-1/4" and 2" connections).
 - (c) Finish to be selected by the Architect from standard finishes.
- E. Audio / Video or communication outlet boxes (up to 2" knockout)
1. Manufacturers
 - a. Raco Co.
 - b. Subject to complying with these specifications the following manufacturers shall be acceptable.
 - 1) Thomas and Betts.
 - 2) Wiremold Co.
 - 3) Appelton Electric.
 - 4) Crouse-Hinds.
 2. RACO 263
 - a. 4-11/16" H x 7-3/4" W x 3-1/4" D

- b. Accepts standard 4" square device and flat covers or RACO 792, 793, 794 3-gang device covers. (2 or 3 gang opening)
 - c. Built-in tabs for spanner bars.
 - d. Includes 1/2" thru 2" knockouts.
 - 1) Side: (6) 1/2-3/4 in., (2) 3/4-1 in., (2) 1 - 1-1/4 in., (2) 1-2 in.
 - 2) Bottom: (2) 1/2-3/4 in., (2) 3/4-1 in., (2) 1 - 1-1/4 in.
 - e. Accepts 981 voltage partition (UL Listed)
 - f. Welded construction.
 - g. Raised ground screw.
 - 3. RACO 260
 - a. 4-11/16" H x 4-11/16" W x 3-1/4" D
 - b. Accepts standard 4-11/16" square device and flat covers.
 - c. Includes 1/2" thru 2" knockouts.
 - 1) Side: (2) 1/2-3/4 in., (2) 3/4-1 in., (2) 1 - 1-1/4 in., (2) 1-2 in.
 - 2) Bottom: (2) 1/2 in., (2) 3/4-1 in.
 - d. Welded construction.
 - e. Raised ground screw.
- F. Recessed Backboxes for Monitor Locations
- 1. Manufacturer:
 - a. Chief Manufacturing.
 - b. Substitutions subject to compliance with requirements from manufacturers other than those listed above may be included.
 - 2. Description: Recessed, metallic, electrical box, with knockouts and single gang box mounting knockouts:
 - a. Pre-wire version: Chief PAC526.
 - b. Include cover kit: Chief PAC526CVRW-KIT.
 - 3. Dimensions: 14-1/4" W x 14-1/4" T x 3.4" deep. Installs between 16" on-center studs.
 - 4. UL listed.
 - a. Below could likely only be used in a light commercial / residential facility. Note the application materials.
- G. Recessed weatherproof boxes
- 1. Manufacturer:
 - a. Arlington Industries.
 - b. Substitutions subject to compliance with requirements from manufacturers other than those listed above may be included.
 - 2. Description: Recessed, metallic, electrical box, with metallic weatherproof in-use cover for:
 - a. Stucco over masonry.
 - b. Wood construction.
 - c. Cement fiber lab siding.
 - 3. Uses standard wall plates.
 - 4. Compatible with wiring devices specified in Section - Wiring Devices.
- H. Poke Thru Floor Boxes
- 1. Poke Through System
 - a. Manufacturers:
 - 1) Wiremold, 6" Evolution Series
 - 2) Substitutions under provisions of Division 01 and Section - Electrical General Requirements.
 - b. Description: Assembly comprising service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.
 - c. Fire Rating: 3 hours.
 - d. Device Plate: Finish to be selected by the Architect from standard colors.

- e. Power: two duplex receptacles.
- f. Communications: See floorbox schedule on the drawings for communications device requirements.
- g. AV: provisions for AV modular jack or pass-through.
- h. Cover: Cast metal articulating cover with openings to allow for cabling to pass through the cover while closed. Pass through openings shall slide open or be closed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Floor Box and Poke Through Locations: Verify all locations and dimensions with architect prior to any installation. Coordinate with furniture locations.
- I. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 - b. Communications Systems Outlets: Comply with Section 27 1000.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- J. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- K. Install boxes plumb and level.
- L. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- M. Install boxes as required to preserve insulation integrity.
- N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Q. Close unused box openings.
- R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- S. Provide grounding and bonding in accordance with Section 26 0526.
- T. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

1.02 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.
- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Transformers:
 - 1) Identify kVA rating.

- 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify load(s) served. Include location when not within sight of equipment.
- c. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- d. Time Switches:
 - 1) Identify load(s) served and associated circuits controlled. Include location.
- e. Enclosed Contactors:
 - 1) Identify voltage and phase.
 - 2) Identify load(s) and associated circuits controlled. Include location.
- f. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
- g. Electricity Meters:
 - 1) Identify load(s) metered.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations indicated.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Packaged HVAC equipment control panels.
 - d. Elevator control panels.
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 3.5 by 5 inches.

- b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
 - c. Service Equipment: Include the following information in accordance with NFPA 70.
 - 1) Nominal system voltage.
 - 2) Available fault current.
 - 3) Clearing time of service overcurrent protective device(s).
 - 4) Date label applied.
- B. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 - 2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
 - 3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 - 4. Use underground warning tape to identify direct buried cables.
- C. Identification for Raceways:
 - 1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
 - 2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
- D. Identification for Boxes:
 - 1. Use voltage markers to identify highest voltage present.
 - 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-paint per the same color code used for raceways.
 - 1) Fire Alarm System: Red.
 - b. For exposed boxes in public areas, do not color code.
 - 3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
 - 1. Identification for Communications Devices: Comply with Section 27 1000.
 - 2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
 - 3. Use identification label to identify fire alarm system devices.
 - 4. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
 - 5. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
- F. Identification for Luminaires:
 - 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.

- b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
- 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
- 1. Minimum Size: 1 inch by 2.5 inches.
 - 2. Legend:
 - a. Equipment designation or other approved description.
 - b. Other information as indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch.
 - b. Other Information: 1/4 inch.
 - 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.
 - c. Fire Alarm System: White text on red background.
- D. Format for Receptacle Identification:
- 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Power source and circuit number or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Black text on clear background.
- E. Format for Control Device Identification:
- 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Load controlled or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Black text on clear background.
- F. Format for Fire Alarm Device Identification:
- 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Designation indicated and device zone or address.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Red text on white background.

2.03 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

2.04 IDENTIFY CONDUIT AND BOXES AS FOLLOWS:

- A. Accessible Raceways 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A: Identify with orange snap-around label or stenciled legend adjacent to each junction box, pull box, and electrical enclosure. Indicate type of system and circuits located within (i.e. Normal or Emergency, 208/120 volt or 480/277 volt, panel ID and circuit number).
- B. Use the following color code for conduit and junction box covers:
 - 1. Fire Alarm - Red.
 - 2. Voice and Data - Blue
 - 3. Access Control - Blue.

2.05 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Conduits: Legible from the floor.
 - 8. Boxes: Outside face of cover.
 - 9. Conductors and Cables: Legible from the point of access.
 - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.

- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Time switches.
- C. Outdoor photo controls.
- D. Daylighting controls.
- E. Lighting contactors.
- F. Accessories.
- G. Digital Load Controllers.
- H. Commissioning of Lighting Control Systems per IECC 2024.

1.02 SYSTEM DESCRIPTION

- A. Lighting controls shall be a networked digital distributed dimming lighting control system for all common, open office, conference, and gathering spaces. Individual offices and small meeting rooms with wall type sensors, bathrooms, and similar rooms can be stand-alone type controls by the same manufacturer. Provide manual controls, daylight responsive controls, occupancy sensors, and time of day controls as described on the drawings and as required to meet the state energy code requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- E. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.
- F. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- J. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- K. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.
- L. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.
- M. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- N. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 QUALITY ASSURANCE

- A. Manufacturer Design Services for Lighting Control Sensors and Controls: Manufacturer shall provide design services to determine final device quantities and locations required to provide complete coverage for areas indicated as needing devices. See requirements for submittal drawings.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
- C. Shop Drawings:
 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
 2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- D. Field Quality Control Reports.
- E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 SUBMITTALS FOR CLOSEOUT

- A. Submit according to the requirements of Division 01 and Section 26 0100.
- B. As-Built Drawings: include as-built drawings showing final locations, and circuit arrangements of all devices included in this section.
- C. Operation and Maintenance Manuals:
 1. Approved and edited copy of Submittals for Review shall be included in the Operation and Maintenance Manuals.
 2. Include copies of all documentation required by part 3 of this specification with the Operation and Maintenance Manual.
 3. Provide System User's Guide and Programmer's Guide in electronic pdf format for the following equipment:
 - a. Distributed digital lighting control system (as applicable).

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- C. Manufacturers:
 - 1. Leviton
 - 2. Douglas Lighting Controls
 - 3. NLight (Acuity)
 - 4. Intelligent Lighting Controls (ILC)
 - 5. Wavelinx CAT (Cooper)
 - 6. Substitutions: See Section 01 6000 - Product Requirements

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 3. Sensor Switch Inc: www.sensorswitch.com/#sle.
 - 4. WattStopper: www.wattstopper.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. All Occupancy Sensors:
 - 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 - 2. Sensor Technology:
 - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
 - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
 - c. Acoustic Occupancy Sensors: Designed to detect occupancy using passive audible sound sensing technologies.
 - d. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 - 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 - 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 - 6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 - 7. Compatibility (Non-Dimming Sensors): Suitable for controlling LED lighting, incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
- C. Wall Switch Occupancy Sensors:
 - 1. All Wall Switch Occupancy Sensors:

- a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - c. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - d. Include 0-10V dimming capability for all wall switch occupancy sensors.
 - e. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
- D. Wall Dimmer Occupancy Sensors:
- 1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
 - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - d. Dimmer: 0-10V manual dimming.
 - e. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
- E. Ceiling Mounted Occupancy Sensors:
- 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - d. Finish: White unless otherwise indicated.
- F. Power Packs for Low Voltage Occupancy Sensors:
- 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 - 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 - 3. Input Supply Voltage: Dual rated for 120/277 V ac.

2.03 TIME SWITCHES

- A. Manufacturers:
- 1. Intermatic, Inc: www.intermatic.com/#sle.
 - 2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Digital Electronic Time Switches:
- 1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
 - 2. Program Capability:
 - a. Astronomic Time Switches: Two channel, capable of different schedule for each day of the week and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.

3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Provide remote photocell input.
8. Input Supply Voltage: As indicated on the drawings.
9. Output Switch Configuration: As required to control the load indicated on drawings.
10. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 1.

2.04 OUTDOOR PHOTO CONTROLS

- A. Manufacturers:
 1. Intermatic, Inc; _____: www.intermatic.com/#sle.
 2. Tork, a division of NSI Industries LLC; _____: www.tork.com/#sle.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Stem-Mounted Outdoor Photo Controls:
 1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 2. Housing: Weatherproof, impact resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Provide external sliding shield for field adjustment of light level activation.
 5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 6. Voltage: As required to control the load indicated on the drawings.
 7. Failure Mode: Fails to the on position.
 8. Load Rating: As required to control the load indicated on the drawings.

2.05 DAYLIGHTING CONTROLS

- A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
- B. Connections to Room Controller to be a minimum of Cat5e cable with RJ45 connectors.
- C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
 1. Sensor Type: Filtered silicon photo diode.
 2. Sensor Range:
 - a. Closed Loop Photo Sensors: 3 to 6,000 footcandles
 3. Finish: White unless otherwise indicated.
- D. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming drivers, for both continuous dimming of compatible dimming drivers and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
 1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
 2. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
 3. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

2.06 LIGHTING CONTACTORS

- A. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- B. Include Hand-Off-Auto switch in the cover with Red pilot light.
- C. Enclosures:
 - 1. Comply with NEMA IA 10030.
 - 2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- D. ACCESSORIES
 - 1. Auxiliary Contacts:
 - a. Comply with NEMA IA 10039.
 - b. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.
 - 2. Pilot Devices:
 - a. Comply with NEMA IA 10039; heavy-duty type.
 - 3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; Selector switch positions shall be ON/OFF/AUTO.
 - 4. Indicating Lights: Push-to-test type unless otherwise indicated. Light shall illuminate when contacts are in the ON position.
 - 5. Provide LED lamp source for indicating lights and illuminated devices.

2.07 DIGITAL LOAD CONTROLLERS

- A. Manufacturers:
 - 1. N-Light
 - 2. Wattstopper DLM
 - 3. Substitutions: See Section 01 60 00 - Product Requirements
- B. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
 - 1. Provide networked operation for both manual, automatic occupancy based, 24-Hr time of day, and 365 day based control per the descriptions of control identified on the drawings.
 - 2. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
 - 3. Simple replacement - Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
 - 4. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are sequentially assigned using each controller's device ID's from highest to lowest.
 - 5. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load

- d. Configuration status
- 6. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
- 7. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - a. Turn on to 100%
 - b. Turn off
 - c. Turn on to last level
- 8. Each load shall at a minimum be configurable to operate in the following sequences based on occupancy:
 - a. Auto-on/Auto-off (Follow on and off)
 - b. Manual-on/Auto-off (Follow off only)
- 9. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
- 10. BACnet object information shall be available for the following objects:
 - a. Load status
 - b. Electrical current (when available)
 - c. Total watts per controller
 - d. Schedule state - normal or after-hours
 - e. Demand response enable and disable
 - f. Room occupancy status
 - g. Total room lighting and plug loads watts
 - h. Total room watts/sq ft
 - i. Force on/off all loads
- 11. UL 2043 plenum rated
- 12. Manual override and LED indication for each load
- 13. Dual voltage (120/277 VAC, 60 Hz). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); plug load controllers carry application-specific UL 20 rating for receptacle control.
- 14. Zero cross circuitry for each load
- 15. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- C. On/Off Room Controllers shall include:
 - 1. One or two relay configuration
 - 2. Efficient 150 mA switching power supply
 - 3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
- D. On/Off/Dimming enhanced Room Controllers shall include:
 - 1. Real time current monitoring
 - 2. Multiple relay configurations
 - a. One, two or three relays
 - 3. Efficient 250 mA switching power supply
 - 4. Four RJ-45 DLM local network ports with integral strain relief and dust cover
 - 5. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting.
 - b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire

- ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads.
- c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
 - d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
 - e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
 - f. Calibration and trim levels must be set per output channel.
 - g. Devices that set calibration or trim levels per controller are not acceptable.
 - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
 7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
 8. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - a. Establish preset level for each load from 0-100%
 - b. Set high and low trim for each load
 - c. Set lamp burn in time for each load up to 100 hours
 9. Override button for each load provides the following functions:
 - a. Press and release for on/off control
 - b. Press and hold for dimming control
- E. Digital Wall Switches
1. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:
 - a. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 2. Two RJ-45 ports for connection to digital lighting control local network.
 3. Multiple digital wall switches may be installed in a room by simply connecting them to the digital lighting control local network. No additional configuration will be required to achieve multi-way switching.
 4. The following switch attributes may be changed or selected:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.
 - c. Individual scenes may be locked to prevent unauthorized change.
 - d. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
- F. Configuration Tools
1. Provide wireless configuration tool and any other programming and set-up tools necessary.

2.08 LOW VOLTAGE LIGHTING CONTROL WIRING

- A. Provide CAT5e (minimum) wiring or higher grade as recommended by the manufacturer for low voltage network lighting control wiring.

- B. Wiring must be plenum rated.
- C. Wiring shall be installed, supported, and terminated per division 27 requirements.
- D. Control wiring for lighting controls shall be a unique color. Provide GREEN wiring, coordinate with other trades and suggest an alternate color if that color is used for other systems.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- G. Provide required supports in accordance with Section 26 05 00.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Program each room controller in each room and verify that it functions correctly. Failure of the programming will require a call back to correct the program.
- J. Program the lighting controls once each area is ready for occupancy or after each phase has been completed.
- K. Identify lighting control devices in accordance with Section 26 0553.
- L. Occupancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- M. Outdoor Photo Control Locations:
1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- N. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- O. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
 2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
 3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each lighting control device for damage and defects.
- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test time switches to verify proper operation.
- E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Engineer.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Engineer. Record settings in written report to be included with submittals.
- E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Engineer.

- F. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Engineer.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

3.08 COMMISSIONING

- A. EC shall provide commissioning of the lighting control systems per IECC 2024 section C408.3.
- B. Provide all documentation and report as required by IECC to the Owner within 90 days of receipt of the certificate of occupancy.

3.09 CLOSEOUT ACTIVITIES

- A. Demonstration: Once each area is ready for occupancy or after each phase has been completed, demonstrate proper operation of lighting control devices to Owner and Engineer, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training or longer for the satisfaction of the Owner.
 - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 4. Location: At project site.
 - 5. Provide any reprogramming, readjusting and training of the lighting control system within one year after occupancy.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.
- D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 67 - Panelboards; Current Edition, Including All Revisions.
- K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.
- N. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

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

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- 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. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
 - 2. Listed series ratings are not acceptable.

- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- L. Load centers are not acceptable.
- M. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase and Neutral Bus Material: Aluminum or copper.
 - 2. Ground Bus Material: Aluminum or copper.
- D. Circuit Breakers:

1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
 2. Provide thermal magnetic circuit breakers unless otherwise indicated.
- E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures unless otherwise indicated.
 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 2. Phase and Neutral Bus Material: Aluminum or copper.
 3. Ground Bus Material: Aluminum or copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit breakers rated 1200A and higher shall incorporate a method for arc fault energy reduction per NFPA 70, article 240.87.
- B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated. Series rated systems are not allowed.
 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

5. Electronic Trip Circuit Breakers (provide where indicated): Furnish solid state, microprocessor-based, true rms sensing trip units.
 - a. Provide the following field-adjustable trip response settings:
 - 1) Long time pickup, adjustable by setting dial.
 - 2) Long time delay.
 - 3) Short time pickup and delay.
 - 4) Instantaneous pickup.
 - 5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
- J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

- K. Provide grounding and bonding in accordance with Section 26 0526.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
- L. Install all field-installed branch devices, components, and accessories.
- M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.
- N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 - 1. Fire detection and alarm circuits.
- Q. Identify panelboards in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- C. Test GFCI circuit breakers to verify proper operation.
- D. Test AFCI circuit breakers to verify proper operation.
- E. Test shunt trips to verify proper operation.
- F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
 - 1. Straight blade receptacles.
 - 2. GFCI type receptacles.
 - 3. Twist-locking receptacles.
- D. Wall plates.
- E. Device plates and decorative box covers

1.02 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R2015).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

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

- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

1.07 MATERIAL AND LABOR ALLOWANCE

- A. The Electrical Contractor shall install the following materials as directed by the Architect during Construction. The cost for all labor, materials, overhead, profit, taxes and other incidental charges shall be included in the base bid. If such items are not required the Owner shall have the right to take possession.
 - 1. Provide ten (10) duplex NEMA 5-20r duplex receptacles with device plate.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- C. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- D. Provide GFCI protection for receptacles serving electric drinking fountains.
- E. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Gray with Stainless Steel wall plate. Verify finish with Architect.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

2.03 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- B. Control: Digital fade type with tap on/off control and touch preset adjustment.
- C. Provide 0-10V dimming as required for the controlled fixtures.

- D. Compatible with the quantity and type of fixtures to be controlled. Dimmers shall be capable of the % dimming listed for the connected fixture types.

2.05 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
 - 3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 - 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
- D. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.06 WALL PLATES

- A. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Stainless Steel Wall Plates : Brushed satin finish, Type 302 stainless steel.
- C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.

- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
 - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.
 - 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.
- N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- P. Identify wiring devices in accordance with Section 26 0553.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Engineer.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
- 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 Fuses: One set(s) of three for each type and size installed.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Individual Motor Branch Circuits: Class RK1, time-delay.

2.02 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
 - 1. Class RK1, Time-Delay Fuses:

- H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.
- B. Elevator Shunt Trip Switches.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- H. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- H. Provide with switch blade contact position that is visible when the cover is open.
- I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 - 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
- K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- L. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- N. Heavy Duty Switches:
 - 1. Comply with NEMA BS 31047.
 - 2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.

- b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
 - a. Provide means for locking handle in the ON position where indicated.

2.03 SHUNT TRIP SWITCHES

- A. Comply with ASME A17.1, UL 98.
- B. Switch Assemblies: NEMA KS 1, UL 98, ASME A17.1, 600V ac, single throw, three pole, horsepower rated, with 200-kA interrupting and short circuit current rating when fitted with Class J fuses.
 - 1. Integral shut trip mechanism and Class J fuse block.
 - 2. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - 3. Handle lockable in OFF position.
 - 4. Control Circuit: Integral control power transformer, with primary and secondary fuses, and sufficient capacity to operate shunt trip, connected pilot light, and indicating and control devices.
 - 5. Accessories:
 - a. Oiltight keyed test switch.
 - b. Oiltight red ON pilot light.
 - c. Isolated 100 percent rated neutral lug.
 - d. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - e. Form C alarm contacts that change state when the switch is tripped.
 - f. Three pole, double throw, fire alarm voltage monitoring relay complying with NFPA 72.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Identify enclosed switches in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.
- B. Test proper operation of shunt trip switch. Verify that shunt trip operates upon receiving signal from fire alarm system. Verify that voltage monitoring contacts are operating correctly and fire alarm system interconnection is operating (i.e. does loss of shunt trip voltage create a supervisory alarm on the fire alarm system).

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
 - 1. Magnetic motor starters.
 - 2. Manual motor starters.
 - 3. Motor-starting switches without overload protection.
- B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- E. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.
- F. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.
- G. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- K. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- L. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. Rockwell Automation, Inc; Allen-Bradley Products: ab.rockwellautomation.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.
- E. Siemens Industry, Inc: www.usa.siemens.com.

2.02 ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
 - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:
 - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
 - b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
 - 2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- E. Conductor Terminations: Suitable for use with the conductors to be installed.
- F. Enclosures:
 - 1. Comply with NEMA IA 10030.
 - 2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - b. Outdoor Locations: Type 3R or Type 4.
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- G. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- H. Magnetic Motor Starters: Combination type unless otherwise indicated.
 - 1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
 - 2. Configuration: Full-voltage non-reversing unless otherwise indicated.
 - 3. Minimum Starter Size: NEMA Size 0.

4. Disconnects: Circuit breaker type.
 - a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
 - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
5. Overload Relays: Bimetallic thermal type unless otherwise indicated.
6. Pilot Devices Required:
 - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
 - b. Single-Speed, Non-Reversing Starters:
 - 1) Pushbuttons: START-STOP.
 - 2) Selector Switches: HAND/OFF/AUTO.
 - 3) Indicating Lights: Red ON, Green OFF.
- I. Manual Motor Starters:
 1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
 2. Configuration: Non-reversing unless otherwise indicated.
 3. Fractional-Horsepower Manual Motor Starters:
 - a. Furnish with toggle operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
 - c. Provide means for locking operator in the OFF position.
 - d. Furnish Red ON indicating light where not within sight of equipment.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 3. Trip-free operation.
 4. Visible trip indication.
 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.
 6. Bimetallic Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - c. Trip test function.
 7. Melting Alloy Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 8. Solid-State Overload Relays:
 - a. Adjustable full load current.
 - b. Phase loss protection.
 - c. Phase imbalance protection.
 - d. Ambient temperature insensitive.
 - e. Thermal memory.
 - f. Trip test function.
 - g. Provide isolated alarm contact.

- B. Fusible Disconnect Switches:
 - 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - 2. Fuse Clips: As required to accept indicated fuses.
 - 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- C. Circuit Breakers:
 - 1. Interrupting Capacity (not applicable to motor circuit protectors):
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Motor Circuit Protectors:
 - a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
 - b. Provide field-adjustable magnetic instantaneous trip setting.

2.04 CONTROL ACCESSORIES

- A. Auxiliary Contacts:
 - 1. Comply with NEMA IA 10039.
 - 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.
- B. Pilot Devices:
 - 1. Comply with NEMA IA 10039; heavy-duty type.
 - 2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 - 3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; HAND/OFF/AUTO selector switch.
 - 4. Indicating Lights: Push-to-test type unless otherwise indicated.
 - 5. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
 - 1. Comply with NEMA IA 10039.
 - 2. Provide number and type of relays indicated or required to perform necessary functions.
- D. Control Power Transformers:
 - 1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices.
 - 2. Include primary and secondary fuses.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 0526.
- G. Install all field-installed devices, components, and accessories.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

3.03 CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 26 3600 - TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 3213 - Engine Generators: For interface with transfer switches.
 - 1. Includes code requirements applicable to work of this section.
 - 2. Includes additional testing requirements.
 - 3. Includes related demonstration and training requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- C. NEMA IA 10042-1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2025.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.
- G. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - a. Engine Generators: See Section 26 3213.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 5. Closed Transition and Soft Loading Transfer Switches:
 - a. Coordinate source interconnection requirements with Utility Company.
 - b. Where applicable, coordinate the work to provide engine generators with isochronous governors suitable for closed transition transfer.
 - c. Coordinate the work to provide shunt trip breakers necessary for protection from source interconnection for longer than specified maximum interconnection time.
 - d. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.

- e. Arrange for inspections necessary to obtain Utility Company approval of installation.
- 6. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
 - 1. Clearly indicate whether proposed short circuit current ratings are based on testing with specific overcurrent protective devices or time durations; indicate short-time ratings where applicable.
- D. Manufacturer's detailed field testing procedures.
- E. Field quality control test reports.
- F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- G. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
 - 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 26 3213.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transfer Switches:
 - 1. ABB/GE; _____: www.geindustrial.com/#sle.
 - 2. ASCO Power Technologies; _____: www.ascopower.com/#sle.
 - 3. Cummins

2.02 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Applications:
- D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- E. Automatic Transfer Switch:
 - 1. Transfer Switch Type: As indicated on the drawings.
 - 2. Transition Configuration: As indicated on the drawings.
 - 3. Voltage: As indicated on the drawings.
 - 4. Ampere Rating: As indicated on the drawings.
 - 5. Neutral Configuration: As indicated on the drawings.
- F. Comply with NEMA IA 10042-1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- I. Switching Methods:
 - 1. Open Transition:
 - a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
 - 2. Neutral Switching: Either simultaneously switched neutral (break-before-make) or overlapping neutral (make-before-break) methods are acceptable.
 - 3. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
- K. Enclosures:
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Short Circuit Current Rating:

1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as indicated on the drawings.

2.03 OPEN TRANSITION TRANSFER SWITCH

- A. Description: Electrically operated, mechanically held, mechanically interlocked to ensure only one of two possible positions, normal or emergency. Positively locked and unaffected by momentary outages.
- B. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- C. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- D. Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.
- E. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.
- F. Withstand and closing ratings with any circuit breaker shall be as listed below or on the drawings. The OTTS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. OTTS's which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable. It shall be acceptable for Contractor to furnish coordination study indicating that rating is based on series rating with the actual circuit breaker provided.
- G. Controller:
 1. The controller's sensing and logic shall be controlled by a built-in microprocessor. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
 2. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance.
- H. Enclosure:
 1. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
 2. Controller shall be flush-mounted display with LED indicators for switch position and source acceptability. It shall also include test and time delay bypass switches.
- I. Operation:
 1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.
 2. Single-phase voltage and frequency sensing of the emergency source shall be provided.
- J. Time Delays:
 1. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
 2. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
 3. A generator stabilization time delay shall be provided after transfer to emergency.

4. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
 5. A 5-minute cool down time delay shall be provided on shutdown of engine generator.
 6. All adjustable time delays shall be field adjustable without the use of special tools.
- K. Features:
1. A set of contacts shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
 2. A push-button type test switch shall be provided to simulate a normal source failure.
 3. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.
 4. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.
 5. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.
 6. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.
 7. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
 8. An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.
 9. An Inphase monitor shall be built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources.
 10. A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.
- L. Accessories:
1. Programmable Engine Exerciser: A seven or fourteen day programmable engine exerciser with digital readout display. Shall include one form C contact for availability of normal and emergency sources. Include "with or without" load control switch for exerciser period. The exerciser shall be backed up by a permanent battery.
 2. Pre-transfer relay: Provide an adjustable pre-transfer relay.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Identify transfer switches and associated system wiring in accordance with Section 26 0553.

3.03 SYSTEM START UP

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. If different manufacturers furnish switchgear and generator sets, technical representatives by both manufacturers' authorized dealers shall verify the installation meets requirements. Any deficiencies shall be noted and corrected by the contractor.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Automatic Transfer Switches:
 - 1. Inspect and test in accordance with NETA ATS, except Section 4.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.
- E. Provide additional inspection and testing as required for completion of associated engine generator testing as specified in Section 26 3213.
- F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
 - 1. Demonstrate operation of transfer switch in bypass (where applicable), normal and alternate source modes.
 - 2. The system manufacturer's authorized local dealer shall provide a complete orientation for all the owner's personnel. Orientation shall include both classroom and hands-on instruction. Topics covered shall include control operation, schematics, wiring diagrams, meters, indicators, warning lights, shutdown system and routine maintenance and testing.

3. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
4. Provide minimum of four hours of training.
5. Instructor: Manufacturer's authorized representative.
6. Location: At project site.

C. Coordinate with related generator demonstration and training as specified in Section 26 3213.

3.07 DOCUMENTATION

- A. Provide written certificate(s) and include a copy with the O&M manuals, indicating that the inspections and tests specified herein have been performed, that Owner Training and Demonstration, and that the installation is in accordance with these specifications. Certificate shall be signed and dated by Contractor.
- B. Furnish a written report of the tests performed.

3.08 PROTECTION

- A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION

SECTION 26 4300 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for service entrance locations.
- B. Surge protective devices for branch panelboard locations.

1.02 REFERENCE STANDARDS

- A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2024).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.
- F. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
 - 1. SPDs with EMI/RFI filter: Include noise attenuation performance.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.07 WARRANTY

- A. Manufacturer's Warranty: Provide minimum ten year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Field-installed, Externally Mounted Surge Protective Devices: Acceptable Manufacturers:
 - 1. ABB/GE: www.geindustrial.com/#sle.
 - 2. Advanced Protection Technologies, Inc (APT): www.aptsurge.com/#sle.
 - 3. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com/#sle.

4. Schneider Electric; Square D Brand Surgellogic Products: www.surgellogic.com/#sle.
5. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.
6. Total Protection Solutions.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
 1. Wye Systems: L-N, L-G, N-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
 2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 1. Indoor clean, dry locations: Type 1.
- H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
 1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

- A. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); Advantage Series; Model LSEB (240 kA/phase, Type 2, I-n = 20 kA); www.surgesuppression.com/#sle.
 1. Voltage: As indicated on drawings.
 2. Features: Discrete "all-mode" protection (10 modes for 3-phase wye circuits); component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 25 year warranty.
 3. Include the following options:
 - a. AC10 - Basic internal audible alarm with dry relay contacts.
 - b. X2 - NEMA 1, 2, 3, 3S, 4, 4X, and 12 composite enclosure.

2.04 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Surge Protective Device:
 1. Protection Circuits: Field-replaceable modular or non-modular.
 2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 5. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).

- a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
- 6. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Drivers.

1.02 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.
- B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- C. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for LED luminaires, including drivers.
- C. Provide five year pro-rata warranty for batteries for emergency lighting units.
- D. Provide five year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products as scheduled.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- J. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
 - 1. LED Tape - General Requirements:
 - a. Listed.
 - b. Designed for field cutting in accordance with listing.

- K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 DRIVERS

- A. Drivers - General Requirements:
 - 1. Driver shall be required to have isolated grounds between 0-10V dimming connection and 277/120V connection built into driver. Drivers with shared grounds shall not be accepted.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - 3. Total Harmonic Distortion: Not greater than 20 percent.
 - 4. Power Factor: Not less than .90.
 - 5. Driver includes TVSS.
 - 6. Driver shall be required to have isolated grounds between 0-10V dimming connection and 277/120V connection built into driver. Drivers with shared grounds shall not be accepted.
 - 7. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 26 2726 or 26 0923.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. 0-10V or low voltage dimming wire shall not be run in same conduit as 120/277V power connection to fixture.
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 4. Secure pendant-mounted luminaires to building structure.
 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- H. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
 4. Install canopies tight to mounting surface.
 5. Unless otherwise indicated, support pendants from swivel hangers.
- J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- K. Install accessories furnished with each luminaire.
- L. Bond products and metal accessories to branch circuit equipment grounding conductor.
- M. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- N. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- O. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

3.05 ADJUSTING

- A. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.

- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Poles and accessories.

1.02 REFERENCE STANDARDS

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2025).
- B. IEEE C2 - National Electrical Safety Code; 2012.
- C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.
- D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- H. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 BALLASTS AND DRIVERS

- A. Ballasts/Drivers - General Requirements:
- B. Drivers - General Requirements:
 - 1. Minimum Efficiency/Efficacy: Provide ballasts/drivers complying with all current applicable federal and state ballast efficiency/efficacy standards.
 - 2. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- C. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.04 POLES

- A. All Poles:
 - 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 - 2. Structural Design Criteria:
 - a. Comply with AASHTO LTS.
 - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 - 1) Design Wind Speed: 100 miles per hour, with gust factor of 1.3.
 - c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
 - 3. Material: As shown on schedule.
 - 4. Shape: As shown on schedule.

5. Finish: Match luminaire finish, unless otherwise indicated.
6. Unless otherwise indicated, provide with the following features/accessories:
 - a. Top cap.
 - b. Handhole.
 - c. Anchor bolts with leveling nuts or leveling shims.
 - d. Anchor base cover.
 - e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
 - f. Provide vibration isolator in each pole.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Recessed Luminaires:
 1. Install trims tight to mounting surface with no visible light leakage.
 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- H. Pole-Mounted Luminaires:
 1. Maintain the following minimum clearances:
 - a. Comply with IEEE C2.
 - b. Comply with utility company requirements.
 2. Foundation-Mounted Poles:
 - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
 - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
 - 2) Position conduits to enter pole shaft.
 - b. Install foundations plumb.
 - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
 - d. Tighten anchor bolt nuts to manufacturer's recommended torque.

- e. Install anchor base covers or anchor bolt covers as indicated.
- 3. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
 - b. Provide supplementary ground rod electrode as specified in Section 26 0526 at each pole bonded to grounding system as indicated.
- 4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
- I. Install accessories furnished with each luminaire.
- J. Bond products and metal accessories to branch circuit equipment grounding conductor.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 27 0000 - STRUCTURED CABLING GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical General Requirements specifically applicable to Division 27 Sections, in addition to Division 01 - General Requirements.
- B. Definitions common to Division 27 specification sections.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 27.
- B. This section is related to all other sections of 27.

1.03 DEFINITIONS

- A. Words "Architect" where written in Division 27 specifications and drawings refer to commissioned Design Professional, whose name appears on contract documents.
- B. Word "Engineer" where written in Division 27, specifications and drawings refers to Consulting Electrical Engineer, Obermiller Nelson Engineering, Inc., 311 Fourth Street South, Suite #110, Grand Forks, ND, 58201; phone (701)775-2594, facsimile (701)775-0231.
- C. Word "Contractor" where written in Division 27 specifications and drawings refers to Electrical Contractor and any and all of his subcontractors.
- D. Word "Material" where written in Division 27, specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.
- E. Word "Labor" where written in Division 27 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.
- F. Word "Provide" where written in Division 27 specifications and drawings shall mean "Electrical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".
- G. Performance Verification Testing refers to test performed in the field to ensure proper operation and / or installation of service or products.
 - 1. Unless noted otherwise Performance Verification Testing is not required to be provided by a 3rd party testing firm.
 - 2. Unless noted otherwise Performance Verification Testing is not required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent
- H. Acceptance Testing refers to formal testing process required prior to acceptance by the Owner.
 - 1. Unless noted otherwise Acceptance Testing is not required to be provided by a 3rd party testing firm.
 - 2. Unless noted otherwise Acceptance Testing is required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent.
- I. As-built drawings are prepared by the contractor. They show, in red ink, on-site changes to the original construction documents.
- J. Record drawings are prepared by the Architect or Engineer and reflect on-site changes the contractor noted in the as-built drawings.
- K. Quality Assurance includes all the planned and systematic activities implemented that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality. Typically, quality assurance procedures are performed before and while the work is being

performed. As such in the Division 27, specifications Quality Assurance procedures are specified in Part 1.

- L. Quality Control includes all the planned activities required to verify quality after the work has been performed. This can include testing and inspections along with other procedures. As such in the Division 27, specifications Quality Assurance procedures are specified in Part 3.

1.04 SCOPE OF WORK

- A. All Specifications, corresponding Drawings and all Addenda form a complete set of documents for electrical work for this project, and no part shall be considered complete without the other.
- B. The Specifications, Drawings, and all Addenda describe both the design characteristics and functional performance criteria that the completed telecommunications systems shall include.
- C. Contractor shall obtain all required licenses, permits, plan reviews, inspections and pay all fees, costs and all other charges for this project. All sales, use and any other taxes shall be paid by Contractor.
- D. Electrical Work shall comply with all ordinances, laws, regulations and codes applicable to the work involved. If, in any instance, the plans and specifications conflict with such laws, the stricter requirement shall take preference.
- E. If Contractor is aware of conflicts between drawings or specifications and such codes or regulations, they shall be brought to the Engineer's attention prior to commencing work. If Contractor performs work in violation of such codes or regulations, Contractor shall correct the violation at his expense.
- F. Work under Division 27, includes providing all labor and materials necessary for satisfactory completion of all electrical work shown on all drawings and in all specification divisions. In general, this consists of the following:
 - 1. Telecommunications Systems.
- G. Site Investigation
 - 1. Prior to submitting bids, visit the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.
 - 2. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions.
 - 3. Where work under this project requires extension, relocation, or modifications to existing equipment, systems or installations the existing equipment, system or installations shall be restored to their original condition, with exception to the work under this project, before completion.
 - 4. Existing equipment, systems and installations which are not detailed on the drawings must still be restored to their original condition.

1.05 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement (contract).
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates: See Division 00 and Division 01.

1.06 DRAWINGS

- A. Drawings indicate the extent and general layout of the structured cabling systems.
- B. The electrical drawings are diagrammatic (that is, designed to demonstrate or explain the scope of work), they are intended to be as accurate as planning can determine.
- C. The scales are shown for estimating purposes only. Field verification of dimensions, locations, and construction details is required. Review appropriate drawings (for example: shop drawings), make field measurements and adjust work to suit the conditions encountered.

Although electrical drawings are diagrammatic, they shall be followed as closely as actual construction permits.

- D. Contractor shall coordinate with civil, architectural, structural, and mechanical construction drawings for locations of partitions, walls, beams, shafts, equipment, etc.
- E. DO NOT SCALE LOCATIONS OF STRUCTURED CABLING OUTLETS OR OTHER DEVICES FROM ELECTRICAL DRAWINGS.
- F. Standard electrical symbols along with special symbols are used on all drawings.

1.07 REGULATORY REQUIREMENTS

- A. Work provided shall comply with the following partial list of governing codes and regulations:
 - 1. International Building Code (IBC).
 - 2. International Fire Code. (IFC).
 - 3. State Fire Codes.
 - 4. State and Local Electric Codes.
 - 5. State Building Code.
 - 6. Serving Utility Regulations.
 - 7. National Fire Protection Association (NFPA) National Fire Codes.
 - a. NFPA 70 - National Electrical Code.
 - b. NFPA 72 - National Fire Alarm and Signaling Code.
 - c. NFPA 101 - Life Safety Code.
 - 8. Williams-Steiger (OSHA) Regulations.
 - 9. Americans with Disabilities Act (ADA) requirements.

1.08 QUALITY ASSURANCE

- A. Notify the Architect or Engineer of any discrepancies in or omissions from the drawings and documents. Interpretations and clarifications during bidding will be made only by written Addenda. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality, and appropriate adjustment will be made after contract award.
- B. Any work not clear to Contractor shall be referred to Architect or Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work, in question, as directed by Architect or Engineer, whose decision shall be final, without additional charges.
- C. By virtue of submitting a bid, Contractor agrees that he is skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that he has carefully reviewed all drawings, all specifications and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.
- D. Should major changes from drawings and specification be necessary, Contractor shall provide notification and secure written approval and agreement concerning such changes before work is started.

1.09 WARRANTY

- A. The Electrical Contractor shall guarantee that all materials and equipment included in their work free of defects caused by flawed workmanship, material or equipment failures.
- B. The warranty guarantee shall extend one year minimum from the date of final acceptance of the work or for as long as normal equipment manufacturer warranties are in effect from the date of final acceptance of the work.
- C. During the warranty period, the Electrical Contractor shall respond by making appropriate corrections or repairs required to correct defect within one week of notification. Notification shall be made by telephone, fax, email, or letter.
- D. The Electrical Contractor shall provide 24-hour service in case of emergency.

1.10 SUBSTITUTIONS

- A. Where substitute materials or prior approved materials are provided, Contractor shall assume all responsibility and pay for all necessary changes resulting from such substitution. This responsibility shall also include any extra costs required by other trades.
- B. Required where specifically noted or where materials are specifically identified by a manufacturer's name, model or catalog number. In these cases only such material may be included in base bid. Prior approval of substitute materials shall be required.
- C. Prior approved substitutions:
 - 1. Requests for prior approval shall be made in accordance with Division 01, as specified below, and indicated in specific specification section.
 - 2. If Contractor desires to furnish materials other than that named, Contractor or supplier shall apply in writing, to Architect, for prior approval of such material at least ten (10) days prior to bid opening date.
 - 3. Requests for prior approved substitution shall indicate specific proposed materials in lieu of those specified together with complete technical data for all such proposed material.
 - 4. All prior approved substitutions will be clearly identified in addenda which will be sent to all bidders well in advance of bid opening. Only material listed on drawings, specifications and addenda shall be provided.
- D. Substitutions after execution of contract: Substitution of materials other than those specifically named in contract documents will be approved, by Architect or Engineer, for following reason only:
 - 1. That material proposed for substitution is equal to or superior, in Engineer and Architect's opinion, to that specified in construction, efficiency, appearance, and utility.
 - 2. That material named in the documents cannot be delivered to project in time to complete work due to conditions beyond control of Contractor.
- E. Equal To and Or Equal: Where materials are specifically identified as "equal to" an identified manufacturer's name, model, or catalogue numbers or where noted as "or equal" manufacturer's complying with the requirements of these specifications not listed may be incorporated in the Work. Such materials must be equal to or superior, in Engineer's opinion, to that specified in construction, efficiency, appearance, and utility.

1.11 GENERAL REQUIREMENTS FOR SUBMITTALS

- A. Submit according to the requirements of Division 01.
- B. General requirements for Submittals for Review
 - 1. Submittal format, general information, and requirements for all submittals:
 - a. At the front of the submittal on a dedicated page(s): name, address, and phone number of equipment vendor, engineer, and contractor.
 - b. At the front of the submittal on dedicated page(s): Any deviation from contract requirements shall be called to attention. No deviation will be permitted without written approval of Architect or Engineer.
 - c. At the front of the submittal on dedicated page(s): Any requests for clarification, selections that must be made, etc. shall be called to attention.
 - d. At the front of the submittal on a dedicated page(s): Include a complete list of equipment included with manufacturer and model number or catalog number.
 - e. Submittals shall be grouped to include complete information for related systems, products, and accessories in a single submittal with tabs, dividers, or other means of separating each different component within the submittal from the next.
 - f. Mark dimensions and values in units to match those specified.
 - g. Drawings and brochures shall be clearly marked as to item to be supplied and shall have designation corresponding to designation on Drawings (for example: enclosed switch data shall indicate for which equipment they are provided).

2. Contractor Review of Submittals
 - a. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to issuing submittal. Each submittal set shall be stamped, signed and dated indicating Contractor review. If the Contractor fails to properly review submittals, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.
 - b. Should the contractor fail to comply with any of the requirements of the specified submittal requirements; then the right is reserved by the Architect or Engineer to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect and / or Engineer, shall be used in the work at no additional cost to the Owner.
 3. Architect / Engineer Review of Submittals
 - a. The submittal will be reviewed with reasonable promptness, and returned to the Contractor (with copies retained by the Engineer and the Architect). No equipment should be released for shipment until submittals have been approved.
 - b. Submittal review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required.
 - c. Approval Stamp: Submittals will be reviewed with the following actions noted:
 - 1) "No Exception Taken" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation.
 - 2) "Reviewed as Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
 - 3) "Revise and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at his discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
 - 4) "Rejected" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required and fabrication or procurement is not authorized.
 4. If the Architect or Engineer rejects (Revise and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews (beyond the first two) at a rate of \$500 per review. Compensation will be incorporated by Change Order and will be deducted from the Contractor's application for payment. Contractor is responsible for all delays caused by the resubmittal process
- C. General Requirements for Submittals For Information
1. Information submittals shall include the information noted in the specifications and information requested by the Architect, Engineer, and / or Owner.
 2. Coordination Drawings: Where this and other specification sections require Coordination Drawings to be submitted meet the requirements defined in Division 01 and as indicated below.
 - a. Prepare documents using software program required by Division 01. If no requirements are listed utilize a software compatible with AutoDesk's AutoCAD.

- b. Submit hardcopies and / or electronic copies as required by Division 01. Drawings and files shall be uniquely labeled.
 - c. Scale shall not be less than 1/8" equal 1 foot.
- D. General Requirements for Submittals for Closeout:
 - 1. As specified in Division 01 and Section 27 0100.
- E. General Requirements for Product Data. The following are minimum requirements.
 - 1. Catalog sheets showing ratings, settings, performance curves and rated capacities.
 - 2. Dimensions, materials, fabrication details, finish.
 - 3. Outline and support point dimensions, arrangement and sizes, roughing-in data, and accessories.
 - 4. Operational Characteristics.
- F. General Requirements for Shop Drawings. The following are minimum requirements.
 - 1. Electrical ratings of equipment; how the components of the equipment are assembled and function together; and how they will be installed on the project.
 - 2. Dimensioned plans, elevations, sections, and details. Show quantities of installed devices, features, and ratings.
 - 3. Detail enclosure types.
 - 4. Detail configuration, current, and voltage ratings.
 - 5. Detail features, characteristics, ratings, and factory settings devices and auxiliary components.
 - 6. Include wiring diagrams.
- G. General Requirements for Manufacturer's Instructions. The following are minimum requirements.
 - 1. Application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
 - 3. Instructions for placing each piece of equipment and system into operation.

1.12 PROJECT SUBCONTRACTOR AND VALUES LISTING

- A. Contractor shall submit, to Architect, a list indicating brands of all major materials, names of all of his subcontractors and a schedule of values for this project. Engineer reserves right to reject any material or subcontractor and question scheduled values.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 27 0100 - STRUCTURED CABLING CLOSE OUT DOCUMENTATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Operations and Maintenance Manuals.
- B. Warranty Documentation.
- C. Maintenance Materials.
- D. As-Built Drawings.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 27
- B. This section is related to all other sections of Division 27.

1.03 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Division 01 and Section - Structured Cabling General Requirements.
- B. Provide operations and maintenance manuals and As-Built drawings.

1.04 SUBMITTALS FOR CLOSEOUT

- A. Provide all documents as described below and in each specification section according to the requirements of Division 01 upon reaching substantial completion of the project unless noted otherwise.

PART 2 PRODUCTS

2.01 OPERATIONS AND MAINTENANCE MANUALS

- A. Bind operations and maintenance manual for electrical system in a hard-back binder.
- B. Provide dedicated manuals for the following:
 - 1. Structured cabling system.
- C. Common Results for Operation and Maintenance Manuals. The following information shall apply to all manuals.
 - 1. Provide a master index at the beginning of manual indicating items included.
 - 2. The first section of each manual shall list the name, address, and phone number of Architect, Electrical Engineer, Contractor, and all associated Subcontractors.
 - 3. Each section shall include an approved and edited copy of submittals for review with review comments.
 - 4. Warranty information shall be provided with each piece and / or type of equipment include Manufacturer's Warranty Statement.
 - 5. Testing Reports shall comply with the requirements of section - Testing of Structured Cabling Systems.
- D. Front cover of each binder shall have the following lettering done in silk screen:
 - 1. *****NAME OF SYSTEM*****
 - 2. **OPERATION AND MAINTENANCE MANUAL**
 - 3. **FOR**
 - 4. **PROJECT NAME, PROJECT LOCATION**
- E. The Division 27 structured cabling manual shall include the following sections with tabs, dividers, or other means of separating each section as well as separating each item from the next within each section. See the applicable sections of the Division 27 specifications for additional information.

1. Cable tray/cable supports.
 2. Equipment racks and cable management.
 3. Fiber cables, enclosures, terminations, etc.
 4. Copper cable entrance protector.
 5. Copper cabling (multi-pair category 3, horizontal UTP cabling).
 6. Patch panels, 110 blocks, etc.
 7. Jacks.
 8. Faceplates and connectors.
 9. Receipts for Spare Materials and Owner Training / Demonstrations.
 10. Test Reports and Certificates.
 11. Operation and Maintenance Guidelines.
 12. Manufacturer's warranty statement.
 13. Contractor's Warranty Statement according to the requirements of specification "Electrical General Requirements."
- F. The Division 27 elevator landing 2-way communications system manual shall include the following sections with dividers between each section and tabs to separate each device with each divided section. See the applicable sections of the Division 27 specifications for additional information.
1. Component catalog and shop drawings.
 2. Operating instructions.
 3. Receipts for Spare Materials and Owner Training / Demonstrations.
 4. Test Reports and Certificates.
 5. Operation and Maintenance Guidelines.
 6. Manufacturer's warranty statement.
 7. Contractor's Warranty Statement according to the requirements of specification "Electrical General Requirements."

2.02 AS-BUILT DRAWINGS

- A. The contractor shall maintain one set of drawings at the job site to be used as a master copy. All changes and deviations shall be clearly marked and noted by colored pencil. These drawings shall be turned over to the Architect upon project completion.
- B. As-Built Drawings shall include the following information in addition to specific information indicated in individual specification sections:
1. Actual locations / configurations of components.
 2. Indicate route and location of all underground structured cabling, raceways, etc
 3. Indicate actual locations and mounting heights of structured cabling outlet boxes, surface metal raceway, and wireway.
 4. Communications outlets shall be labeled on As-Built Drawings with information corresponding to labels field installed.
 5. Indication of final location, mounting method, and route of Communications cabling pathways.
- C. Indicate other information specifically noted in other Division 27 specification sections.

2.03 MAINTENANCE MATERIALS

- A. Turn over to owner and obtain signed receipt for all maintenance materials, spare parts, touched up parts and loose items.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 27 0500 - COMMON WORK RESULTS FOR STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope general construction materials and methods for application with electrical, communications, and electronic safety and security systems installations.
- B. Materials specified herein include:
 - 1. Miscellaneous for support of structured cabling materials and equipment.
 - 2. Hangers and Supports.
 - 3. Joint sealers for sealing around structured cabling materials and equipment; and for sealing penetrations in walls, floors, ceilings, roofs, foundations for moisture, water, smoke, fire and acoustic control.
- C. General electric construction methods and requirements specified herein include:
 - 1. Material and workmanship.
 - 2. Product manufacturer requirements.
 - 3. Coordination.
 - 4. Safety.
 - 5. Material handling, storage protection, cleaning and painting.
 - 6. Cutting, patching and finishing.
 - 7. Penetrations.
 - 8. Wiring Methods.
 - 9. System Interruptions.
 - 10. Outlet mounting heights.
 - 11. Structured Cabling demolition and remodeling.
 - 12. Equipment Wiring (connections).
- D. Owner Instruction and Demonstration.

1.02 REGULATORY REQUIREMENTS

- A. See Section 27 0000.

1.03 COMMON REQUIREMENTS FOR QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.
- B. Installer Qualifications: Engage experienced Installers for Work.
- C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- D. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide UL Labeled and listed access door assembly with flush door, frame, hinge, and latch from manufacturer listing in the UL "Building Materials Directory" for rating shown.
- E. Standardization of Product Manufacturer:
 - 1. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.
 - 2. Wiring devices and other items covered under a single specification section, with the, shall be of the same manufacturer and style whenever practical or where failure to do so is visibly noticeable.

F. Material and Workmanship:

1. All materials provided shall be new and shall be approved by the Underwriters Laboratories, Inc., NFPA, NEMA, and ANSI as conforming to its standards in every case where such a standard has been established for such material.
2. Materials shall be standard products of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.
3. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
4. All workmanship shall be neat and complete in both effectiveness and appearance and shall be executed by persons licensed and skilled in the trade. Engineer reserves the right to reject any material or workmanship before, during or after construction.
5. Materials and Finishes: Provide adequate corrosion resistance to eliminate staining of exposed surfaces.
6. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

G. Coordination:

1. See also "Quality Assurance" paragraph of Section 27 0000.
2. Discrepancies and omissions discovered during construction shall immediately be called to the attention of the Architect or Engineer for clarification.
3. Installation of materials shall be coordinated with other trades and installed at such time and manner as to not delay or interfere with the work of other trades.
4. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections. Determine connection locations and requirements.
5. Sequence and coordinate work with other trades so as to avoid conflict of space and time sequence. If interference develops, the matter shall be brought to the attention of the Architect for decision.
6. Organize the work so that progress of work will conform to the progress of other trades. Give particular attention to large equipment requiring positioning prior to closing the building.
7. Complete the entire installation as soon as building conditions permit.
8. This Contractor shall be held solely responsible for coordinating proper size and location of hangers, slots, chases, openings, etc., required for proper installation of his work and shall arrange with the proper building contractors for inserts, chases, and openings.
9. Refer to drawings and specifications of all other divisions and trades for correlating information, location and details of work, dimensions, etc. Coordinate location of all outlets and equipment. If conflicts develop Architect or Engineer's decision will govern. No additional compensation will be allowed for moving of un-coordinated, misplaced or poorly located outlets, material, equipment or work.

H. Pre-installation meetings are required as noted in this and other specification sections and are intended to help coordination efforts. Structured Cabling Contractor shall schedule and convene a pre-installation meeting with all affected trades as noted in specifications and on Drawings.

I. Provide competent representative(s) on site constantly to supervise work from beginning through completion and final acceptance. So far as possible contractor shall keep same foreman and workmen throughout project duration.

J. During its progress, the work shall be subject to observation by representatives of Owner, Architect and Engineer at which times Contractor shall furnish all required information and cooperation

1.04 SAFETY

A. Comply with the requirements of Division 01 and this specification.

- B. Perform work in accordance with NFPA 70E and in compliance with OSHA requirements.
- C. Do not perform work on exposed live electrical equipment.

1.05 SUBMITTALS FOR CLOSEOUT

- A. Submit according to requirements of Division 01 and Section 27 0100.
- B. Include product information and installation details with O & M manuals for fire resistant joint sealers and fire resistant sleeves.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Manufacturers
 - a. RACO.
 - b. Appelton
 - c. Caddy
 - d. B-Line
 - e. Substitutions: Under provisions of Division 01 and Section - Structured Cabling General Requirements.
 - 2. Concrete Structural Elements: Use precast insert system, expansion anchors, powder actuated anchors and preset inserts.
 - 3. Steel Structural Elements: Use beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 4. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 5. Hollow Masonry and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 6. Solid Masonry Walls: Use expansion anchors and preset inserts.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.
- B. Steel Channel:
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.
 - b. Unistrut ®.
 - c. Substitutions: Under provisions of Division 01 and Section - Structured Cabling General Requirements.
 - 2. Description:
 - a. Hot dip galvanized where located outdoors and in wet/damp locations.
 - b. Painted steel indoors in dry locations.
 - c. Paint cut ends of channel in damp locations.
 - d. Stainless steel or nonmetallic channel as shown on plans.
- C. Powder Activated Anchors: Remington. Substitutions: Under provisions of Division 01 and Section - Structured Cabling General Requirements.
- D. Spring Steel Clips:
 - 1. Caddy
 - 2. Steel City
 - 3. Substitutions: Under provisions of Division 01 and Section - Structured Cabling General Requirements
- E. Miscellaneous Metals:
 - 1. Steel plates, shapes, bars, and bar grating: ASTM A 36.
 - 2. Cold-Formed Steel Tubing: ASTM A 500.
 - 3. Hot-Rolled Steel Tubing: ASTM A 501.
 - 4. Steel Pipe: ASTM A 53, Schedule 40, welded.

5. Nonshrink, Nonmetallic Grout: Premixed, factory-packed, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
6. Fasteners: Zinc-coated, type, grade, and class as required.

2.02 JOINT SEALERS

- A. General: Joint sealers, joint fill material, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Project engineer from manufacturer's standard colors.
- C. Provide fire resistant joint sealers as specified in Division 07.
- D. Fire-Resistant Joint Sealers: One-part or two-part, foamed-in-place, sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, ducts and through penetrations through fire-rated walls, ceilings, roofs and floors. Sealants and accessories shall have required fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.03 SLEEVES

- A. Sleeves for Raceways and Cables
 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized Steel.
 2. Rectangular Sleeves: Galvanized Sheet Steel. 16 Gauge for less than 50 square inches and not side longer than 16 inches. 8 gauge for greater than 16 inches or one side more than 16 inches.
- B. Sleeve Seals
 1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Link Seal.
 3. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 4. Pressure Plates: Carbon steel. Include two for each sealing element.
 5. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element
 6. Provide fire rated seals as required. See Division 07.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR EXAMINATION PRIOR TO STRUCTURED CABLING INSTALLATIONS

- A. Verify conditions and constructions types prior to installation.
- B. Verify that surfaces that support Product(s) are ready to receive them.
- C. Examine location of equipment installation for compliance with installation tolerances and other conditions affecting performance of Work
 1. Prepare drawings showing proposed rearrangement of work to meet Project conditions, including changes to work specified in other Divisions. Obtain permission of Architect before proceeding.

- D. Review all Drawings including architectural, mechanical, structural, civil, and electrical drawings for extent of Work.
 - 1. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
- E. Examine Architectural drawings and elevations to verify device locations and mounting heights.
 - 1. In finished spaces, where mounting heights are not detailed or dimensioned coordinate mounting height with Architect.
 - 2. Do not rough-in for any wall mounted equipment without verifying mounting height with Architect unless equipment is specifically noted on Architectural Drawings.
 - 3. Do not scale dimensions from Electrical Drawings and verify all mounting heights noted on Electrical Drawings.
- F. Site Investigation
 - 1. Prior to beginning work, examine the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.
 - 2. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions prior to beginning work.
 - 3. Existing equipment, systems and installations whether or not they are not detailed on the drawings must be restored to their original condition.

3.02 COMMON REQUIREMENTS FOR PREPARATION TO INSTALLATION

- A. Equipment Wiring preparation
 - 1. Obtain and review shop drawings, product catalog data, etc. prior to roughing-in for structured cabling connections.
 - 2. Verify dimensions and final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - 3. Refer to equipment drawings and specifications in all specification Divisions for rough-in requirements.
- B. Telecommunications Service Entrance preparation
 - 1. Coordinate location of Telecommunication Company's facilities to ensure proper access is available.
 - 2. Verify that field measurements are as indicated on Telecommunication Company drawings.
 - 3. Pre-Installation meeting: Convene two weeks prior to commencing work of this section with Telecommunication Company representative, General Contractor, and other trades affected by site work to coordinate final location underground telecommunication Work.
- C. Hangers and Supports preparation
 - 1. Coordinate the installation of required supporting devices, inserts and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Strength of construction shall not be impaired.
 - 2. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for structured cabling installations. Strength of construction shall not be impaired.

3.03 COMMON INSTALLATION REQUIREMENTS FOR STRUCTURED CABLING WORK

- A. Description Of Wiring Methods:
 - 1. All wiring shall be installed in accordance with applicable codes and as noted in Section 270000, unless otherwise indicated.
- B. Install products in accordance with manufacturer's instructions.
- C. Install work in locations shown on drawings, unless prevented by Project conditions. Refer to architectural drawings for exact devices locations.

- D. Conform to arrangements indicated by Contract Documents, recognizing that the Work is shown only in diagrammatic form.
- E. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- F. Install materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- G. Core drilling of concrete is required, where possible, in lieu of hammer drilling. Hammer drilling is generally to be limited to small holes for anchors.
- H. Install access door assembly where units are concealed behind finished surfaces. Access doors are specified in Division 08 and this section.
- I. Hangers and Supports
 - 1. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
 - 2. Do not fasten supports to pipes, ducts, mechanical equipment and conduit. Do not drill or cut structural members.
 - 3. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- J. Floor, Wall And Ceiling Penetrations
 - 1. Effectively seal penetrations in exterior walls, roofs, and rated interior walls in accordance with Division 07.
 - 2. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access door units. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 3. Conduits and cables passing through floors, walls, and ceilings at the following locations shall be sealed for the purpose of sound, heat, smoke and / or moisture control.
 - a. Acoustically rated walls.
 - b. Fire and / or smoke resistant walls and floors.
 - c. All electrical rooms.
 - d. All mechanical rooms.
 - e. Penthouse.
 - f. All exterior walls.
 - g. All vertical and horizontal shafts.
 - h. All walls around janitor rooms, receiving rooms, and other facility maintenance and management rooms.
 - i. Food service areas.
 - 4. Where conduits and raceways pass through interior walls and ceilings (not requiring water proofing) provide suitable sealing material complying with Division 07 for the wall construction; examples:
 - a. Plaster for plaster walls.
 - b. Joint compound for gypsum board walls.
 - c. Mortar for masonry block and brick walls.
 - d. Grout for concrete walls.
 - 5. Place sealing material around each conduit and raceway for the full thickness of the wall.
 - 6. Where conduits and raceways pass through exterior walls and ceilings below grade, provide installation to meet the details noted on the Drawings.
 - 7. Where interior walls require waterproof conduit and raceway seals, provide silicone sealant generally installed as specified above for exterior walls.

8. Where conduits and raceways pass through exterior walls above grade, provide matching wall material inside (see examples above) and provide waterproof seal of silicone sealant or other approved sealant on outside.
 9. At the nearest point of access to wires (inside conduit or raceway) passing through exterior walls and roof; provide "Ductseal" between wires and conduit or raceway as a wind barrier.
 10. Where cables pass through walls, ceilings and floors, generally use same sealing method as for conduits.
 11. "Ductseal" type material is generally not acceptable except as noted above.
 12. Utilize fire rated cabling pathways where cabling must be routed through fire-rated floor and wall assemblies.
- K. Roof Penetrations
1. Structured Cabling Contractor shall be responsible for providing roof seals for each raceway, mast, tower leg, guy wire, etc., which pass through roof, rest on roof or attach to roof. Avoid roof penetrations where possible. This work shall be performed by the Roofing Contractor. Structured Cabling Contractor shall coordinate work as needed.
- L. Cutting, Patching, and Finishing
1. General: Perform cutting, patching and finishing in accordance with Division 01.
 - a. Cut, remove, and legally dispose of material including but not limited to construction material, and other indicated material made obsolete by the new work.
 - b. Protect the structure, furnishings, finishes, and adjacent materials and installations not indicated or scheduled to be cut or removed.
 - c. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt into adjacent areas.
 - d. The Contractor shall not endanger the stability of the structure by cutting, excavation or otherwise.
 - e. Do not cut or alter work of any other trade without trade and Architect / Engineer's consent.
 2. Perform cutting, patching and finishing of walls, floors, ceilings, roofs required to:
 - a. Uncover work to provide for installation of new or ill-timed work.
 - b. Remove and replace defective work.
 - c. Remove samples of installed work as specified for testing.
 3. Upon written instructions from the Architect / Engineer, uncover and restore work to provide for Engineer's observation of concealed work.
 4. Should any cutting be required for proper installation of structured cabling work because of failure to give the General Contractor the proper information at the time required, such cutting shall be done at the structured cabling Contractors expense.
- M. Equipment wiring installation
1. Provide all necessary boxes, raceways, and wiring required to make equipment and systems complete and operable.
 2. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.
 3. Install structured cabling equipment to facilitate servicing, maintenance, and repair or replacement of structured cabling components.
 4. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 5. Make structured cabling connections in accordance with equipment manufacturer's instructions.
 6. Make conduit connections to equipment using flexible metal conduit. Use liquidtight flexible metal conduit with watertight connectors in damp or wet locations.
 7. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

8. Provide suitable structured cabling receptacle outlet to accommodate connection with attachments.
9. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

3.04 TELECOMMUNICATION SERVICE

- A. Make arrangements with Telecommunication Company to obtain permanent telecomm service to the Project.
- B. Coordinate location of Telecommunication Company's facilities to ensure proper access is available.
- C. Verify that field measurements are as indicated on Telecommunication Company drawings.
- D. Pre-Installation meeting: Convene two weeks prior to commencing work of this section with Telecommunication Company representative, General Contractor, and other trades affected by site work to coordinate final location of underground structured cabling Work.
- E. In addition to his own investigations, the Contractor is encouraged to call the following marking services prior to digging for any underground work:
 1. Minnesota - 1-800-252-1166 (Gopher one call)

3.05 EQUIPMENT AND DEVICE MOUNTING HEIGHTS

- A. Coordinate final mounting heights as directed under Part 3 paragraph "Preparation".
- B. Interior mounting heights indicated on drawings are from finished floors (interior) or final grade (exterior). Mounting heights for items indicated on exterior walls are from the interior finished floor below.
- C. Mounting heights indicated are to the top of the device plate unless noted otherwise. Mounting heights are nominal and shall be adjusted to fit block joints.
- D. Typical mounting heights are detailed on the Drawings.
- E. Contractor shall verify mounting heights of all outlets to assure installation above top of radiation covers, mirrors, counters, vanity, cabinets, and any other obstruction that may alter indicated mounting heights. ADA accessible controls must be mounted at 48".

3.06 COMMON REQUIREMENTS FOR OWNER INSTRUCTION AND DEMONSTRATION

- A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment and operation of all parts of the communications equipment to the Owner's employees who are to have charge of the equipment. Including but not limited to the following:
 1. Demonstrate the proper operation of systems per the operational and function requirements of the Contract Documents and as outlined in any sequence of operation.
 2. Instruct personnel, in all phases of operation, location of components and use of all systems.
 3. Review manufacturer Warranty information for all equipment included in the manual.
- B. Number of hours of instruction shall be specified in other sections of this specification.
- C. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- D. Documentation: Upon completion of Owner Instruction and Demonstration provide a certificate signed and dated by the attendees indicating information covered, amount of instruction / demonstration time provided, and applicable specification sections. Provide certificate for all Owner Instruction and Demonstration sessions. Include copy with O & M Manual. A sample certificate is attached for reference.

3.07 FIELD QUALITY CONTROL

- A. So far as possible contractor shall keep same foreman and workmen throughout project duration. Keep enough workmen on job to insure keeping up with or ahead of other trades so that no delays occur.
- B. Delivery, Storage, and Handling
 - 1. Deliver, store, protect and handle products on site under provisions of Division 01 according to manufacturer's recommendations and as specified herein.
 - 2. This Contractor shall make provisions for delivery and safe storage of materials.
 - 3. Accept Products on site. Inspect for damage
 - 4. Protect Products from corrosion and entrance of debris. Provide appropriate covering. During construction, it shall be the responsibility of this Contractor to protect the surface of equipment and material furnished.
 - 5. See individual specifications sections for specific delivery, storage, handling and protection requirements.

3.08 CLEAN-UP, KEY CONTROL, AND PAINTING

- A. Remove all packing materials, rubbish, debris, etc. from the site each day.
- B. String all furnished keys on split metal key ring and turn same over to Owner at project completion.

END OF SECTION

SECTION 27 0528 - PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pathways include
 1. Cable Tray/Runway.
 2. Conduit and Backboxes.
 3. Hangers and Supports.
 4. Non-continuous Cable Supports.

1.02 SUBMITTALS FOR REVIEW

- A. Submit according to the requirements of Division 1 and Section - Electrical General Requirements.
- B. Provide submittal for each product specified.

1.03 SUBMITTALS FOR CLOSEOUT

- A. Record Drawings: Indicate actual route of and locations of cable tray, non-continuous cable support systems, and conduits 1-1/4" and larger. Indicate actual locations of outlets. Include description of installed grounding and bonding system, note locations of connections to grounding electrode system and / or building steel system.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

- A. As specified in section - Basic Electrical Materials and Methods.

2.02 NON-CONTINUOUS CABLE SUPPORT SYSTEM

- A. Manufacturer: Erico CableCat or Equal.
- B. Description:
 1. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; UL Listed.
 2. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
 3. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
 4. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
 5. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
 6. Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM or approved equal.
- C. Cable Tie Type: Equal to Panduit Extra-heavy cable tie mounts.
- D. Cable Tie and Loop: Equal to Panduit Tak-Ty hook and loop cable tie mounts.
- E. Accessories
 1. Cable Pulley
 - a. Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included. The pulley shall be made of plastic and be without sharp edges. The pin and bail assembly must be able to be secured to the J-Hook during cable installation. The pulley must remain secured while cables are being pulled.
 - b. The pin and roller assembly must be removed after cables are installed.

- c. Acceptable products: ERICO CADDY CAT32PLR, CAT64PLR, or approved equal.
- 2. Cable Protector
 - a. The protective steel tube shall fit over threaded rod and be at least 4" in length.
 - b. The tube shall prevent damage to cables placed in or pulled through CAT-CMTM U-hooks. The tube shall not inhibit the pulling of cables.
 - c. Acceptable products: ERICO CAT-CMTM CATTBCM, or approved equal.

2.03 CONDUIT AND BACKBOXES

- A. As specified in Section - Raceway and Boxes for Electrical Systems.
- B. Provide a minimum of 1" conduit for raceways serving communications outlets.

2.04 CABLE RUNWAY

- A. Manufacturer:
 - 1. Hoffman
 - 2. Panduit
 - 3. Basor Electric
 - 4. MP Husky
 - 5. Cope
 - 6. Substitutions: According to Division 01 and Section 26 0000.
- B. Ladder rack / cable runway for use in telecommunication rooms and spaces.
 - 1. Provide for all tray shown in data rooms.
- C. UL listed for Equipment grounding (straight and curved sections).
 - 1. Classified as suitable for an equipment grounding conductor.
 - 2. Provide required grounding jumper kits.
- D. Cross members 9" on center.
- E. Butt splice kits and junction-splice kits. Provide as needed to install as indicated on drawings.
- F. Black polyester powder coat.
- G. Width: as indicated on Drawings.
 - 1. Provide two radius drop kits minimum per rack and at each point where runway meets wall.
- H. Supports:
 - 1. Provide support racks as required to suspend runway from ceiling where span from wall to wall is longer than manufacturer's maximum dimension between supports. Center support kits only.
 - 2. Provide triangle support racks to support runway from wall where runway is routed along wall.
 - 3. Provide wall angle support where runway terminates at a wall.
- I. Accessories
 - 1. Provide (2) radiused cable drop outs (waterfall type) from the tray at each rack location.

2.05 WIRE BASKET-TYPE CABLE TRAY

- A. Manufacturers:
 - 1. B line
 - 2. Cablofil
 - 3. Chalfant
 - 4. Basor Electric
 - 5. MP Husky
 - 6. Cope
 - 7. Substitutions under provisions of Division 01 and Section - Electrical General Requirements.

- B. Description: NEMA VE 1, Class 20C wire basket type tray.
- C. Material: Steel
- D. Finish: Zinc coated.
- E. Inside Width: As indicated on drawings.
- F. Inside Depth: 4" unless noted otherwise.
- G. Hangers:
 - 1. Center hung.
 - 2. Wall mounted.
 - 3. Trapeze.
- H. Fittings: Provide vertical and/or horizontal tees and/or bends with radius as required or as indicated on drawings. Match straight section tray type.
- I. Provide manufacturer's standard clamps, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- J. Covers: Solid, ASTM A 525, mill-galvanized before fabrication.

2.06 WARNING SIGNS

- A. Engraved Nameplates: Black letters on yellow laminated plastic nameplate, engraved with the following wording:
 - 1. WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

2.07 FIRESTOP (FIRE-RATED CABLE PENETRATION)

- A. Manufacturer: STI "EZ Path"
 - 1. Specified Technology Inc. - EZ Path.
 - 2. Hilti.
 - 3. Substitutions under provisions of Division 01 and Section - Electrical General Requirements.
- B. Description:
 - 1. Automatically adjusts to cable fill via intumescent insert material allowing for 0 to 100-percent visual fill of conductors.
 - 2. Includes both internal and external fire stopping.
 - 3. Cables penetrating through fire-rated floors or walls shall utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
 - 4. The device shall be tested for smoke leakage (L rating).
 - 5. Wire devices shall be of a sufficient size to accommodate the quantity and size of electrical wires and data cables required and shall be suitable for use with new or existing cable installations.
- C. 1.5", 3", or 4" as required for project conditions or as noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Review location of installation to verify suitability of products installation. Verify environmental conditions are within manufacturer's suggested tolerances.

3.02 PREPARATION

- A. Pre-installation meeting: Convene one week prior to commencing work of this section with General Contractor, Mechanical Contractor and all affected trades to coordinate route, clearances, etc.

- B. The contractor must coordinate the installation of the new pathways with other trades and project requirements. Revise locations and elevations from those indicated as required to suit field conditions and as approved by Owner representative,
- C. The contractor shall reference the related sections listed above to determine any additional requirements necessary to complete the project.
- D. Coordinate locations of required fire-rated construction with Architect.

3.03 INSTALLATION

- A. General Requirements:
 - 1. The communications cabling pathways shall provide a route from the building's communications rooms to the communication outlet and provide a neat and workmanlike installation. Cables shall be routed parallel to or at right angles to building lines.
 - 2. All products are to be installed per the manufacturer's instructions and procedures.
 - 3. All pathways must remain accessible and useable after completion.
- B. Conduit Requirements:
- C. Minimum conduit size of $\frac{3}{4}$ ".
- D. The conduit will extend from the outlet box to the accessible ceiling space.
 - 1. Conduit needs to run in the most direct route possible, usually parallel with building lines and in a workman like manner.
 - 2. Junction / Pull boxes shall be required to limit the total bend radius in conduit to 180 degrees for communication systems cabling pathways. Install junction / pull boxes of appropriate size in conduit runs to limit the conduit to 180 degrees of total bend.
 - 3. Bend limitation may be increased to 270 degrees by upsizing the conduit one trade size.
 - 4. Terminate conduit entering telecommunications rooms from below within 4" of finished floor. Terminate conduit entering telecommunications rooms from above within 4" of ceiling or 12" above cable tray.
 - 5. Terminate the end of each conduit above ceiling with a plastic bushing to protect the cabling.
- E. Back box requirements:
 - 1. The communication system outlet box will be a 4"x4" square box fitted with a single gang mud ring unless noted otherwise.
 - 2. Communication system outlets are not to be installed back to back.
 - 3. Firestop the outlet box using a listed UL application in firewalls.
- F. Non-Continuous Cable Support Requirements:
 - 1. Install system Category compliant cable supports every 36" where cable tray is not used.
 - 2. Install such that cabling is routed parallel to or at right angles to building lines.
- G. Cable Tray System:
 - 1. Cable tray will be installed where shown on drawings.
 - 2. Cable tray system shall not be loaded beyond 60% of manufacturer's recommended load capacity.
 - 3. Support trays in accordance with manufacturer's instructions. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 8 ft maximum.
 - 4. Coordinate with other trades to provide for adequate clearances.
 - 5. Bond cable tray to building's grounding electrode system (preferably the building steel) at intervals no greater than 60' using manufacturer approved methods and products (minimum #10 AWG insulated stranded copper conductor where the tray system is not bonded to the building steel through a metallic support system).
 - 6. Provide continuity between tray components, bond together with a minimum of #10 AWG insulated stranded bonding jumper.

7. Install warning signs at 50 feet centers along cable tray, located to be visible.
- H. Fire Rate Cabling Penetrations
1. Utilize UL listed removable/re-usable fire stopping assemblies where required.
 2. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction.

END OF SECTION

SECTION 27 1000 - STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Copper cable and terminations.
- B. Fiber optic cable and interconnecting devices.
- C. Communications equipment room fittings.
- D. Communications outlets.
- E. Communications grounding and bonding.
- F. Communications identification.

1.02 REFERENCE STANDARDS

- A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.
- B. ICEA S-83-596 - Indoor Optical Cable; 2021.
- C. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).
- F. TIA-492CAAB - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak; 2000 (Reaffirmed 2005).
- G. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement; 2015a (Reaffirmed 2022).
- H. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; IEC 61280-4.1 Edition 3.1, Fiber Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement; 2023d.
- I. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.
- J. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009, with Addendum (2016).
- K. TIA-568-C.3 - Optical Fiber Cabling Components Standard; 2016.
- L. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009c, with Addendum (2016).
- M. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.
- N. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
- O. TIA-569-D - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).
- P. TIA-598-D - Optical Fiber Cable Color Coding; 2014d.
- Q. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.
- R. TIA-606-B - Administration Standard for Telecommunications Infrastructure; Rev B, 2012 (with Addenda; 2015).
- S. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

- T. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).
- U. UL 444 - Communications Cables; Current Edition, Including All Revisions.
- V. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.
- W. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.03 DEFINITIONS / TERMS / ACRONYMS

A. Acronyms

1. ANSI - American Northern Standards Institute
2. AWG - American Wire Gauge
3. BC - Bare Copper
4. BICSI - Building Industry Consulting Service International
5. CCS - Copper Clad Steel
6. CEA - Consumer Electronics Association
7. EIA - Electronics Industry Alliance - Ceased Operation Feb. 2011
8. IEC - International Electrotechnical Commission
9. IEEE - Institute of Electrical and Electronic Engineers
10. LAN: Local area network
11. NECA - National Electrical Contractors Association
12. NFPA - National Fire Protection Agency
13. RCDD: Registered Communications Distribution Designer.
14. TIA - Telecommunications Industry Association
15. UL - Underwriters Laboratory

B. Terms / Definitions (See also Section 26 0000)

1. 1GBase-T - networking protocol capable of transmitting 1 billion bits of information per second over copper twisted pair
2. 10GBase-T - networking protocol capable of transmitting 10 billion bits of information per second over copper twisted pair
3. 10GBase-SX - networking protocol capable of transmitting 10 billion bits of information per second over optical fiber at 850 nanometers
4. Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities and equipment rooms within or between buildings.
5. Backbone Cabling: Cabling and connecting hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.
6. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails
7. Cabling: The term "cabling" will mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.
8. Connector 8P8C (Jack): A female connector that has eight positions and eight conductors. Jacks are typically used to terminate eight conductor category rated cable at the user end and are inserted into faceplates to create a connection point for the user's equipment cord.
9. Equipment Outlet (EO): A device also known as the outlet or information outlet placed at the user workstation for termination using connectors (jacks) of horizontal media for connectivity of data and voice at teacher work area outlet, multimedia equipment. These outlets provide the connection point to voice, data, and other media services.
10. Horizontal Cabling: The cabling between and including the work area outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room.
11. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

12. Permanent Link: Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
13. Pull Point: A Pull Point is a space used to transition between floors for backbone and horizontal cabling within a building riser system.
14. Telecommunications: A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds; that is, information, of any nature by cable, radio, optical, or other electromagnetic systems

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- B. Evidence of qualifications for installer.
- C. Field Test Reports.
- D. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

- A. Contractor Qualifications:
 1. A firm currently engaged and which has been continuously engaged for the past 5 years in the installation of applications of type required for this Project, and which can provide documentation of four completed projects similar in size and complexity to this project.
 2. The installing Contractor shall have a minimum one (1) Certified Installer trained to the latest industry standards to ensure the most reliable installation available.
 3. The Contractor shall have one (1) Certified BICSI level 2 Technician for every five (5) labors.
 4. The Contractor shall have written documentation stating the Level III Tester used on this project has been factory calibrated within the last 12 months.
 5. Contractor must provide documentation that they are manufacturer approved and certified for any wire system they propose to install.
 6. Contractor shall designate one person as the installation project manager / foreman who will take charge of overall project and be on-site while work is being performed and be present for project meetings when appropriate. Attendance at project meetings is mandatory unless absence is requested and agreed upon prior to meeting.
- B. Source Limitations: Obtain units of the same type of equipment through one source from a signal manufacturer.
- C. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-568-C.
- D. Coordination:

1. Contractor shall coordinate with the Owner's network and computer equipment personnel for specific instructions before starting Work.
 2. Contractor shall coordinate with the General Contractor for location and type of blocking to be installed in the walls to support wall mounted equipment.
 3. Contractor shall coordinate location of electrical receptacles to be installed on raceways, racks or inside cabinets.
- E. Comply with the requirements of the utility companies.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall provide a 1 year parts and labor warranty against defective workmanship and/or system component failure.
- C. UTP Horizontal Copper Cable: Contractor shall execute a minimum 20-year Applications Assurance Warranty for parts and labor to support stated applications from the connectivity Manufacturer.
 1. System Manufacturer(s) warrant that CAT 6 certified network installations will exceed the defined ANSI/TIA-568 C series industry specifications in force at the time of product purchase. Furthermore, the products that comprise the certified cabling system will meet or exceed the applicable performance specifications in effect at the time of manufacture
 2. This warranty covers the copper and fiber optic permanent links of the network as defined by ANSI/TIA-568-C which includes the cable and connecting hardware. This warranty will be extended to include the entire channel provided that the applicable patch cords and equipment cords are utilized, and all products are installed within areas protected from outside elements.
 3. Supplier will honor claims on this warranty for a minimum of 20-years (which is referred to as the "Warranty Period"). If system performance or material fails to meet the appropriate industry specification, the owner must notify Supplier, in writing, within ten 10 days of defect discovery date. If a warranty claim is determined by Supplier in its sole discretion to be valid, Supplier will, at its option, replace or repair the defective components of the permanent link. Supplier may reimburse the claimant for necessary and reasonable labor costs, provided prior approval is obtained from Supplier. The liability of Supplier for the above remedies shall not exceed \$300 per each network permanent link or end-user drop.
 4. The electrical performance provided by the combination of the different components of the permanent link will be certified by Supplier to meet the applicable performance specifications in effect at the time of manufacture as long as each condition listed below is met
 - a. The network cabling infrastructure must be designed in accordance with ANSI/TIA-568 C Series Standards, and installed by a Manufacturer Certified or Supplier approved designers and installers. Supplier is not liable for design errors or improper construction.
 - b. Each permanent link or channel in the network must be field tested in accordance with the ANSI/TIA-568 C series industry standard in force at the time of purchase AND the installed permanent links and channels must have passed all applicable TIA and performance requirements. Minimum testing for copper systems includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PS NEXT, ELFEXT, and PS ELFEXT.
 - c. Appropriate Warranty Application form must be properly completed and submitted to Supplier prior to initiating the installation. The Warranty Submittal Form must be submitted within 10 days of installation completion. Copies of all certification test reports must be submitted as part of the Warranty Submittal Form, and be kept on file by the registrant to be re-submitted when requested by Supplier. Data must be saved in raw data and summary formats. Submitting the data via online upload, e-mail or on disc are the preferred methods for providing test data

5. This minimum 20-year warranty will be void unless the system is maintained in accordance with industry standards and no changes are made after warranty issuance and acceptance date, unless Supplier grants written consent
6. A claim will be reviewed and held as valid only if all of the following are satisfied
 - a. Reported within ten (10) days of date of defect discovery.
 - b. ALL installation records are provided (original network installation design prints, test results, warranty submittal form).
 - c. Copies of all original receipts for materials and labor from the date of initial installation.
 - d. Supplier has full and open access to inspect and evaluate the installation site.
7. Supplier warrants to Buyer that at the time of delivery the goods sold hereunder will be free from defects in design, material, and manufacture and will conform substantially to the Supplier's applicable specifications as stated herein. Supplier's liability and Buyer's remedy under this warranty are strictly limited to the repair or replacement specified above.

1.08 DELIVERY STORAGE AND HANDLING

- A. Contractor shall ensure that materials delivery to work area shall be coordinated with construction site manager responsible for materials distribution to all trades.
- B. Contractor is responsible for all materials, tools and vehicles left on the job site.
- C. Contractor shall coordinate a disposal bin for the removal of all trash produced by the Contractor's associated personnel during the project
- D. Contractor shall ensure materials are stored in an environmental area where:
 1. Temperature does not exceed 120 degrees Fahrenheit nor below 32 degrees Fahrenheit.
 2. Humidity does not exceed 80 %.
 3. No direct exposure to sunlight.
- E. Cable shall be stored according to Manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable will be stored off site at the Contractor's expense.
- F. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection
- G. Inspect and report concealed damage to carrier within specified time.
- H. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location will be protected to prevent moisture from entering enclosures and material.
- I. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
- J. The equipment will be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer will be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.

1.09 MATERIAL AND LABOR ALLOWANCE

- A. The Contractor shall provide the following as directed by the Architect during Construction. The cost for all labor, materials, overhead, profit, taxes and other incidental charges shall be included in the base bid. If such items are not required the Owner shall have the right to take possession or a deduct may be applied to the contract.

1. Provide 1500 feet of UTP copper horizontal cabling with (10) jacks and testing for (10) additional horizontal cable runs, and (5) additional wall plates.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
 1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
 2. Comply with Communications Service Provider requirements.
 3. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
 4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
 5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
- B. System Description:
 1. Building Entrance Cable: By others.
 2. Backbones - Within Building: Fiber optic, Single Mode -fiber.
 3. Horizontal Cabling: Copper.
- C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
 1. Locate main distribution frame as indicated on the drawings.
 2. The MDF is existing and is located in the Courthouse building to the east.
- D. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
 1. Locate intermediate distribution frames as indicated on the drawings.
- E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.
- F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 COPPER CABLE AND TERMINATIONS

- A. Copper Horizontal Cable CAT6A:
 1. Manufacturer:
 - a. General (Cable)
 - b. Panduit NetKey (Jacks)
 - c. Commscope Uniprise
 - d. Berk-Tek / Leviton
 - e. Mohawk (Cable)
 - f. Belden (KeyConnect Jacks)
 - g. Substitutions according to provisions of Section – Electrical General Requirements.
 2. Equal to General Cable GenSPEED 10
 3. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
 4. Cable Type - Voice and Data: TIA-568.2 Category 6A UTP (unshielded twisted pair); 23 AWG.
 5. Cable Capacity: 4-pair.

6. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
 7. Cable Jacket Color
 - a. Typical Data Cabling: Blue
 - b. Cabling for Camera and SCADA Jacks: Yellow
- B. Copper Horizontal Cable CAT6:
1. Manufacturer:
 - a. General (Cable)
 - b. Panduit NetKey (Jacks)
 - c. Commscope Uniprise
 - d. Berk-Tek / Leviton
 - e. Mohawk (Cable)
 - f. Belden (KeyConnect Jacks)
 - g. Substitutions according to provisions of Section – Electrical General Requirements.
 2. Equal to General Cable GenSPEED 6
 3. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
 4. Cable Jacket Color:
 - a. Typical Data Cabling: Blue
 - b. Cabling for Camera and SCADA Jacks: Yellow
- C. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
- D. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.
 2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
- E. Faceplates:
1. Accept a minimum of four (4) modular jacks.
 2. Provide blank filler plates where extra ports are not used.
 3. Color to match adjacent wiring devices.
 4. Material shall match plates specified in 262726.
 5. Similar to Panduit Classic Style.
- F. Copper Patch Cords:
1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
 2. Patch Cords for Patch Panels:
 - a. Quantity: One for each pair of patch panel ports.
 - b. Length: 3 feet.

2.03 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

- A. Fiber Optic Horizontal Cable:
1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
 2. Cable Type: Single Mode, 9/125 micrometer (OS2) Complying with TIA-492CAAB. Maximum attenuation coefficient: 0.4dB/km at 1310 nm; 0.4dB/km at 1550 nm.
 3. Cable Capacity: Quantity of fibers as indicated on drawings.
 4. Cable Applications: Use listed NFPA 70 Type OFNP plenum cable unless otherwise indicated.
 5. Cable Construction

- a. Distribution type.
 - b. Individually jacketed bundles for strand counts greater than 24
 - c. Interlocked armor with flame retardant, color coded outer jacket.
 - d. Jacket Material: Fire retardant PVC, OFNP rated.
- B. Fiber Optic Interconnecting Devices:
 - 1. Connector Type: Type LC. Verify connect
 - 2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
 - 3. Maximum Attenuation/Insertion Loss: 0.3 dB.
- C. Fiber Optic Patch Cords:
 - 1. Description: Factory-fabricated 2-fiber cable assemblies with suitable connectors at each end.

2.04 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

- A. Copper Cross-Connection Equipment:
 - 1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
 - a. Flat front, non-angled design.
 - b. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 24 ports per standard width panel.
 - c. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
 - d. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
 - e. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.
 - f. Provide incoming cable strain relief and routing guides on back of panel.
 - g. Equal to Panduit.
- B. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
 - 1. Size: 48 by 96 inches.
 - 2. Do not paint over UL label.
- C. Equipment Frames, Racks and Cabinets:
 - 1. Manufacturers:
 - a. Hoffman
 - b. Panduit
 - c. Ortronics
 - d. Chatsworth.
 - e. Belden
 - f. Or Equal.
 - 2. Component Racks: EIA/ECA-310 standard 19 inch wide.
 - 3. General (common to all racks)
 - a. Cabinet shall have dedicated bonding points for proper grounding according to ANSI-J-STD-607B. Furnish and install ground terminal block/lug for each rack and #6 ground wire to room ground bus bar.
 - b. Universal hole pattern on the front and rear flanges, and threaded mounting holes on both sides of rack assembly for management.
 - c. Racks will be black in color.
 - d. Racks will have 12-24 threaded equipment mounting holes
 - e. Horizontal cable support bar on rear of each patch panel/cross connect block panel to support hook and loop (Velcro) strain reliefs. Cables will not rely on terminations for cable support.

- f. Hook and loop (Velcro) cable strain relief system on rear of rack to support horizontal and backbone cables.
 - g. All hardware, supplementary steel, channel and supports as required properly assembling the rack and supporting it to the building structure.
 - h. All equipment racks and their hardware will match in appearance and will be provided by a single manufacturer.
 - i. Furnish and install horizontal wire management units, quantity and type as indicated on the drawings.
- 4. Floor Rack (2-post)
 - a. Provide a minimum of (1) 2-post rack in each new Data room. Provide additional if noted on the plans.
 - b. Structural aluminum construction
 - c. Two 3-inch wide vertical rail channels
 - d. Two-piece angle base (front and rear).
 - e. Two top angle frame members.
 - f. Hook and loop (Velcro) horizontal and vertical cable management on front of rack for dressing patch cable and cross connect wiring.
 - g. Hook and loop (Velcro) cable management system independent of cable management to properly dress the electronic equipment power cords through the rack maintaining as much clearances between the two as possible.
 - h. Furnish and install vertical wire management channels on both side of racks.
- D. Cable Management:
 - 1. Manufacturers:
 - a. Hoffman
 - b. Panduit
 - c. Ortronics
 - d. Leviton
 - e. Belden
 - f. Or Equal.
 - 2. Vertical Cable Management:
 - a. Supply Full Height Vertical Cable Management on each side of rack, front and rear 6" deep.
 - 3. Horizontal Cable Management:
 - a. Supply Horizontal Cable Management between each patch panel and Ethernet Switch.
 - b. Type:
 - 1) Horizontal and vertical distribution rings
 - 2) Plastic construction panel and rings
 - 3) 2" height x 2.5" deep, 19" wide
 - 4) 1 rack unit
 - 5) Rack or cabinet mounted
 - c. Type:
 - 1) Horizontal distribution rings
 - 2) Plastic construction panel and rings
 - 3) 3" height x 4" deep x 19" wide
 - 4) 2 rack units
 - d. Rack or cabinet mounted
 - 4. Cable Management Rings:
 - a. D-Ring for use at termination boards.
 - b. Size as required for quantity of cables
 - c. Black, flexible, one-piece polycarbonate construction.

2.05 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606.
- B. Comply with TIA-606-B.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Comply with Communication Service Provider requirements.
- C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.
- D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- E. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.
- F. Do not install equipment and materials that have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review will be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer will be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- G. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets
- H. Verify that interior of building has been protected from weather.
- I. Verify that mechanical work likely to damage wire and cable has been completed.
- J. Verify that raceway installation is complete and supported.

3.02 INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:
 - 1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
 - 2. 12 inches from power conduits and cables and panelboards.
 - 3. 5 inches from fluorescent and high frequency lighting fixtures.
 - 4. 6 inches from flues, hot water pipes, and steam pipes.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
 - 1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
 - 2. Do not over-cinch or crush cables.
 - 3. Do not exceed manufacturer's recommended cable pull tension.
 - 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
- B. All cable and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All cable and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
- C. Cable Supports

1. Tie wraps for horizontal cables will be secured with minimum required compression in order to secure the cables properly without impeding the signal transmission rating (geometry) of the cable. Hook and loop (Velcro) cable wraps may be used in lieu of cable ties for copper cables only.
- D. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
 1. At Distribution Frames: 120 inches.
 2. At Outlets - Copper: 12 inches.
 3. At Outlets - Optical Fiber: 39 inches.
- E. Copper Cabling:
 1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
 2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
 3. Use T568B wiring configuration.
- F. Fiber Optic Cabling:
 1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
 2. Support vertical cable at intervals as recommended by manufacturer.
- G. Wall-Mounted Racks and Enclosures:
 1. Install to plywood backboards only, unless otherwise indicated.
 2. Mount so height of topmost panel does not exceed 78 inches above floor.
- H. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
- I. Identification:
 1. Use wire and cable markers to identify cables at each end.
 2. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.
 3. All communications equipment racks, cabinets, backboards and other termination hardware shall be labeled at the top left hand corner of each piece of equipment. With a minimum 3/4" high identification label, identifying the room and rack location numbering system.
 4. All communication copper and fiber patch panels shall be labeled with a minimum 3/8" high identification label identifying panels and sequential port numbering system.
 5. All face plates locations shall be labeled with a minimum 3/16" high label indicating the room rack, patch panel and port number.
 6. No hand written labeling will be allowed.
 7. The chosen alphanumeric labeling system shall be approved by Owner prior to any permit labeling system shall be installed.
 8. IDC style connecting hardware shall be color coded per the code identified the BICSI TDMM.
- J. Separation from EMI sources:
 1. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment will be as follows
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment will be as follows
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
- 3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures will be as follows
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
- 4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
- 5. Separation between Communications Cables and Fluorescent or LED Fixtures: A minimum of 5 inches.
- K. Cable Protection
 - 1. Provide bushings in all metal studs and the like where cables will pass through. Bushings will be of two (2)-piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.
 - 2. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided, will be protected from chafing or any damage. The Installer will verify that the warranty will not be violated before installing any cabling in these locations.
 - 3. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.
 - 4. Cables damaged during installation will not be repaired. They will be completely replaced with new cable at no cost to the Owner.

3.04 PREPARATION

- A. Equipment and systems will not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- B. Any and all material installed or work performed in violation of above requirements will be re-adjusted and corrected by the Installer without charge
- C. Obtain and review detailed information on installation requirements from the Manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents include all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing in.
- D. Completely and thoroughly swab raceway before installing wire.
- E. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.
- F. Coordinate layout and installation of communication equipment.
- G. The contractor shall not be responsible for making the cross connect between the indoor cable termination and the OSP cable field, unless otherwise instructed.
- H. Contractor shall coordinate all cable pathways on site with other trades before construction.

3.05 FIRESTOPPING

- A. Work, in general, includes furnishing and installing fire and smoke barrier penetration seals for openings in floor, walls, and other elements of construction.
- B. Comply with requirements in Division 07 Section "Penetration Firestopping."
- C. Comply with TIA/EIA-569-C, Annex A, "Firestopping."
- D. Comply with BICSI TDM, "Firestopping Systems" Article.
- E. Applicator Qualifications: Two years' experience installing UL classified firestopping.

- F. Performance of materials will have been tested to provide fire rating equal to that of the construction.
- G. Existing Project Conditions:
 - 1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
 - 2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- H. Environmental Requirements:
 - 1. Furnish adequate ventilation if using solvent.
 - 2. Furnish forced air ventilation during installation if required by Manufacturer.
 - 3. Keep flammable materials away from sparks or flame.
 - 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
- I. Warranties: Submit copies of written warranty, minimum of one year, agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted Manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period will be one year from date of substantial completion.
- J. Acceptable Manufacturers: Subject to compliance with requirements, provide products of Nelson Fire Protection Products or Engineers approved equal.
- K. Materials:
 - 1. Provide materials classified by UL to provide Fire Barrier equal to time rating of construction being penetrated.
 - 2. Provide asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.
- L. Preparation: Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.
- M. Installation:
 - 1. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with Manufacturer's instructions.
 - 2. Seal holes or voids made by penetration to ensure an effective smoke barrier.
 - 3. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
 - 4. Protect materials from damage on surfaces subject to traffic.
- N. Field Quality Control:
 - 1. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
 - 2. Keep areas of work accessible until inspection by applicable code authorities.
 - 3. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.
- O. Adjusting and Cleaning:
 - 1. Clean up spills of liquid components.
 - 2. Neatly cut and trim materials as required.
 - 3. Remove equipment, materials and debris, leaving area in undamaged clean condition.

3.06 SEALING OF PENETRATIONS AND OPENINGS

- A. All firestop systems will be installed in accordance with the Manufacturer's recommendations and will be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.
- B. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion will not be substantially increased.
- C. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings will be fire stopped using approved methods and NRTL listed products to maintain the fire resistance rating.
- D. Installation restrictions of the listing agencies will be strictly adhered to e.g. 24 inch minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall.
- E. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways will be soft, pliable, non-hardening fire stop putty. Putty will be water resistant and intumescent.
- F. Fire stopping in locations not likely to require frequent modification will be NRTL listed putty or caulk to meet the required fire resistance rating.
- G. Box penetrations into a fire rated wall or shaft will have a fire-stopping pad installed on the back of the box.
- H. Fire stopping of cable trays through walls will be with NRTL listed bags to meet the required fire resistive rating and that will not allow products of combustion to pass through the protected opening. The NRTL listed bags will be installed inside and on both sides of the opening as required to meet the required resistive fire rating of the wall.
- I. Fire stopping materials will be NRTL listed to UL 1479 (ASTM E814). Installation methods will conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials will be as manufactured by 3M, International Protective Coatings Corp., Specified Technologies, Inc., Carborundum Company, RayChem, Nelson Fire Stop or approved equal.

3.07 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

- A. Comply with ANSI/TIA-607 B.
- B. TBB placed in ferrous metallic conduit that exceeds 1m(3 ft) in length, will be bonded to each end of the conduit with a conductor sized as a NO. 6AWG, minimum.
- C. The TBB conductor will be bonded to the service equipment (power) ground.
- D. All Telecommunications Bonding Backbone (TBB) Cables will be insulated and installed in conduit between manholes, telecommunications closets, building steel frame and building electrical grounding system
- E. TBB cables will interconnect all Telecommunications Grounding Busbars (TGB) with the Telecommunications Main Grounding Busbar (TMGB). The TBB will originate at the TMGB and extend throughout the building and connects to all the TGB's in telecommunications closets and equipment rooms. See details on Drawings.
- F. The TBB will be installed without splices, where practicable. If splices are necessary they will be minimum in number accessible and located in telecommunications spaces. Joined segments will be connected using irreversible compression-type connectors, exothermic welding or equivalent.
- G. Unless noted otherwise, The TBB will be No. 3/0 AWG between TMGB and TGB's. The TBB from one TGB to another TGB will be No. 6 AWG. The TBB from TGB to the panel board in the same telecommunications space will be No. 6 AWG. All TBB connections to the TGB will utilize listed 2-hole compression connectors.

- H. Exothermic welds will be used to connect TBB from TMGB or TGB and building steel frame. All other connections will use 2-hole compression connectors.

3.08 HORIZONTAL COPPER CABLE INSTALLATION

- A. Common work for communication systems shall be installed in a neat and workman like manner. The NEIS Standard Practices for Good Workmanship in Electrical Contracting NECA 1-2006 and BICSI/TIA/EIA Telecommunications Cabling Installation Manual latest edition is hereby adopted to define such workmanship and the installation of communications equipment room fitting.
- B. Each jack shall be cabled directly from the telecommunication room to the remote outlet location via the communications cabling pathway (no splices).
- C. Wiring Method: Install horizontal cabling in raceways and cable trays except within racks, D-rings, on plywood backboard, cabinets, and except in accessible ceiling spaces where non-continuous cable support system may be used. Conceal raceway and cables except in unfinished spaces.
- D. 10 ft. length X 12" diameter service loop shall be provided at work station location, above accessible ceiling.
- E. Cables shall be bundled in like jacketed color groups and general directions of cable paths.
- F. Utilize D-ring and color-coded flexible straps at termination board for vertical and horizontal cable management.
- G. Maximum horizontal cabling length: 295 feet.
- H. The cable's manufacturer's minimum bend radius and maximum pulling tension shall not be exceeded.
- I. Wire all jacks according to ANSI/TIA/EIA T568-B configuration.
 - 1. The UTP cabling systems will have TIA/EIA T568B pin/pair termination assignment. All conductors provided will be properly and consistently terminated at both ends throughout the entire systems. Maintain proper untwist of pairs and removal of jacket per TIA and BICSI
- J. Horizontal cabling shall be terminated such that wire pair twists are maintained as closely as possible to the point of mechanical termination. (No greater than 0.5" for category 5e or 6 cables.)
- K. Horizontal wiring within equipment rooms and closets:
 - 1. Bundle, lace, and train cables within cable tray / racks / D-rings.
 - 2. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radius.
 - 3. Provide and use wiring management.
 - 4. Cable paths shall be installed in vertical and horizontal right angle configurations.
- L. Terminations:
 - 1. Voice: Patch Panels.
 - 2. Data: Patch Panels.
- M. Provide cross-connect cable / patch cords for the voice system for Owner provided telephone equipment.
- N. Provide cross-connect cable / patch cord for the data system for Owner provided data equipment.
- O. Securely mount equipment racks / cabinets per manufacturer's recommendations.
- P. Provide 25% spare capacity at copper cross-connect blocks, patch panels, and cable management system for future expansion.

3.09 FACEPLATES INSTALLATION

- A. All face plates shall be installed in a vertically plumb position, if this is not possible, notify other trades for corrective action.
- B. Excess cable service loops shall not be stored in back box, cables should be pulled back into ceiling space.
- C. All un-used plate opening shall be filled with blanks.
- D. All face plates locations shall be labeled according to specification section Identification for Electrical Systems.

3.10 TELECOMMUNICATION EQUIPMENT ROOM INSTALLATION

- A. 25ft Service Loops for all backbone cables / cable types shall be provided at each communication room or closet. The cable shall be neatly bundled and stored on wall or in ceiling for future expansion.
- B. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools
- C. Equipment Racks and Panels
 - 1. Securely mount equipment cabinet and racks to the building structure. Proper supports such as 3/8" lag screws and expansion anchors will be used. Proper quantity of supports will be utilized. Dry wall screws and other types of supports not specifically approved to support equipment are specifically prohibited. Submit mounting supports for approval before installation.
 - 2. Equipment cabinet mounted on or against walls will have 3-foot clearance in front of deepest component.
 - 3. Patch Panels: Mount patch panels into the cabinet/rack in top-to-bottom fashion with the first patch panel (Fiber) mounted at the top of the "Active" equipment rack. Uniquely label each patch panel according to the numbering convention outlined in the SECTION on labeling. Each port will also have color-coded identifiers. Refer to details on the Drawings.
 - 4. Cable Management: Secure the cable bundle(s) to the rack strain relief and cable management behind the patch panels and cross connect block panels. Install horizontal cable management panels and brackets for routing and management of patch cables. Maintain TIA/EIA and BICSI standards on bundling, supporting and bend radii.
 - 5. Surge Protected Outlet Strips: Mount surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.
- D. Bonding and Grounding:
 - 1. See specification Section 26 0526.
 - 2. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 - 3. Cabinet and racks shall have dedicated bonding connection for proper grounding according to ANSI-J-STD-607-B.
 - 4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 10 AWG equipment grounding conductor.
- E. Copper backbone cable shall be landed on a 110 style cross field. Terminated to 568B wiring specifications.
- F. Cable shall be terminated on the same category rated blocks or higher than the installed cable.
- G. 110 Connecting Blocks shall be mounted on a plywood backboard or rack mounted.
- H. A trough Style cable management system for cross connecting blocks shall be provided.
- I. The cross connect field shall be designed for 25% growth, for future changes.

- J. All communications equipment racks, cabinets, backboards and other termination hardware shall be labeled at the top left hand corner of each piece of equipment. With a minimum 3/4" high identification label, identifying the room and rack location numbering system.
- K. All communication copper and fiber patch panels shall be labeled with a minimum 3/8" high identification label identifying panels and sequential port numbering system.

3.11 BACKBONE CABLE INSTALLATION

- A. All cables not installed in raceways shall be riser or plenum rated.
- B. Backbone cables shall be grouped separately from horizontal distribution cables. Cable for other systems shall be grouped separately from cables for telephone and data
- C. Each cable run between terminating locations shall be one continuous cable (no splices or connections). No mid span fiber splicing shall be permitted on backbone cable runs.
- D. All wires shall be marked at all junction boxes, pull boxes, cabinets, boxes and terminations.
- E. The Contractor shall install cable in such a manner as to prevent stretching, kinking or sharp bends. Cable damaged during installation or not passing required testing shall be removed and replaced at no additional cost to Owner
- F. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminations, and too much jacket removed
- G. Minimum bend radius and maximum pulling tension for all cables shall be maintained during and after installation. Install cable in accordance with manufacturer's ratings and instructions
- H. The armoring of cable shall be maintained into the fiber termination cabinet and used as the cable restraint. The armor shall be also be properly grounded.
- I. Installation of Backbone cable within the ER:
 - 1. The cable shall be secured to the ER wall or other specified location using Velcro cable wrap brackets.
 - 2. Cables shall be neatly bundled with hook and loop type fasteners. Nylon tire wraps are not acceptable. Cables must be neatly bundled in the telecommunications spaces and at the cable service loop
 - 3. The end of the cable, exclusive of the coil of slack, shall be routed to the splice housing mounted within the equipment rack for furcation and termination.
 - 4. Leave a maximum of 6 feet of buffer tube in the fiber optic enclosures. Secure the cable to the wall or equipment frame using Velcro cable wraps.
 - 5. Cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed
 - 6. Dress and attach cables to the backboard along the shortest possible route run square (horizontal and vertical) to the backboard. Bundle similarly routed cables together and attach by means of clamps or distribution rings. Cable dress and attachment shall minimize obstruction to future installations of equipment, backboard, or other cables
- J. Cable service loops shall be provided at both ends of backbone cable runs:
 - 1. At the telecommunications room, provide a minimum 8 foot service loop stored in a figure eight pattern in the cable tray above the racks/cabinets.
 - 2. At the telecommunications room, provide sufficient slack to properly dress and terminate cables at the racks and cabinets
 - a. Provide sufficient slack so that swing gate type racks and cabinets can open fully
 - b. Provide sufficient slack so that cables do not catch or bind at swing gate type rack or cabinet hinge and the cables do not pull taught across the hinge or edge
 - 3. A minimum 25 foot service loop shall be maintained at each building entrance and exit

- K. A break-away link shall be used for installation of cables with a cable-puller or winch. The break-away link shall be designed to separate at or below the recommended maximum tension of the cable being installed
- L. Any damage to Owner's existing cabling or existing cable owned by others, caused as a result of work performed under this scope, shall be brought to the Owner's attention and repaired or replaced within 48 hours.
- M. Contractor shall use only cable lubricants recommended by the manufacturer for use with the specific cable construction.
- N. Should a cable become kinked, skinned or stretched during installation, the cable shall be removed and replaced at no additional cost to the Owner. Splicing at points other than those specified will not be acceptable.
- O. Furcation of Fiber Optic Cable: Prior to termination, fiber optic cable strands will be furcated (fanned out) using the specified furcation kits and using the procedure specified by the manufacturer.
- P. Termination of Fiber Optic Cable
 - 1. Where specified, the Contractor shall terminate the individual fiber strands with connectors according to the manufacturer's specifications.
 - 2. Upon final testing, mated-pair connector attenuation shall not exceed 0.75 dB. Connectors which exceed this level of attenuation shall be cut off and fibers re-terminated by the Contractor.
 - 3. Terminated fibers shall be installed within a fiber termination panel mounted within an equipment rack, as specified on the Drawings.

3.12 IDENTIFICATION

- A. See Section - Identification for Electrical Systems for additional product information.
- B. All components of the structured cabling system shall be labeled including but not limited to cables, connecting blocks, patch panels, racks, cabinets, and outlet plates.
- C. Identification conventions shall match the Owner's current labeling convention. If there is no current labeling convention or the current convention is no longer adequate the following shall be used.
- D. Cables shall be identified at each end. Same designation shall be used at both ends.
 - 1. A basic labeling convention of sequential numbering shall be used.
 - 2. Provide wire markers as follows for horizontal UTP copper cabling in the following format
 - a. Telecommunications Room Name / Outlet Room Number / Cable Function / Faceplate Number
 - b. Example: TTTT / XXXX / D (for Data) or V (for Voice) / 01-99
 - c. Label cables within outlet boxes and within 4" of each termination.
 - 3. Provide wire markers on horizontal coaxial cabling with the following:
 - a. Format: Telecommunications Room Name / Outlet Room Number / Faceplate Number
 - b. Example: TTTT / XXXX / 01-99
 - c. Label cables within outlet boxes and within 4" of each termination
 - 4. Provide wire markers on backbone cables with the following:
 - a. Telecommunications room at the opposite end of the cable
 - b. Pair count for twisted pair cables
 - c. Strand count for fiber optic cables.
- E. Outlet faceplates shall be identified.
 - 1. Room number - faceplate sequence within room (clockwise from north) - X# where X indicates use (D for data, V for voice, W for wi-fi, C for coax CATV) and # is the jack sequence (clockwise from top right).

- F. Racks shall be identified as indicated on Drawings. If not designation are made on the Drawings submit an RFI with suggested naming convention.
- G. Rack mounted termination equipment (patch panels, IDC connectors, fiber enclosures, etc.) shall be identified by color (as noted in BICSI TDMM) and by row within termination field, and by position within a particular terminal block or patch panel, etc.

3.13 GENERAL QUALITY CONTROL

- 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.
- C. 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.
- D. Protect installed products until completion of project.
- E. Touch-up, repair damaged products before Substantial Completion.
- F. The engineer reserves the right to a 10% random retest of horizontal station cables at no additional cost to the Owner.
- G. Failure to meet industry test standards will require the contractor replace non-performing components at their own exposure.
- H. After installation, equipment will be protected to prevent damage during the construction period. Openings in conduits and boxes will be closed to prevent the entrance of foreign materials.

3.14 HORIZONTAL COPPER CABLING FIELD QUALITY CONTROL

- A. Communications horizontal copper cabling shall be 100% tested.
- B. Field Testing Equipment: Submit during shop drawing review on the testing equipment to be utilized on this project. The installer shall test all cables installed under this Section
 - 1. The cable tester shall have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.
 - 2. Testing shall be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.
 - 3. Provide factory calibration report of field test equipment.
- C. Testing Procedure:
 - 1. Testing shall conform to ANSI/TIA-568-C.0 standard.
 - 2. Testing will be to the Permanent Link Test Parameters.
 - 3. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.
 - 4. Test each UTP cable and passive components. Provide certification that entire installation of UTP cabling, equipment and jacks are NRTL certified meeting or exceeding a minimum of category performance specified on all four pairs of conductors.
 - 5. Tests shall be based on each pair of conductors and not the aggregate multiple pair results.
 - 6. Test all installed cable segments end-to-end, from the telecommunications room horizontal patch panel/cross connect block panel to each work area outlet and from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, and from the work area outlet to the main cross-connect (through patch cables or cross- connect wiring) with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to latest TIA performance

requirements, as well as NEXT, ELFEXT, structural return loss, alternating power sum, opens, shorts, continuity, cable length, and characteristic impedance.

7. Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include retermination or replacement of the cable, which fails. No cables passing within tolerance only (Conditional Pass*) will be accepted.

D. Test results:

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.
2. Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
3. Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).
4. Test Results shall include the following:
 - a. Applicable Telecommunications Room number
 - b. Circuit I.D. number with corresponding jack identifier
 - c. Wire Map - shall include the following:
 - 1) Continuity to the remote end
 - 2) Shorts between any two or more conductors
 - 3) Crossed pairs
 - 4) Reversed pairs
 - 5) Split pairs
 - 6) Any other miswiring
 - d. Length
 - e. Insertion Loss
 - f. Near-end Crosstalk (NEXT) Loss
 - g. PS-NEXT (Power Sum Near End Cross Talk)
 - h. ELFEXT (Equal Level Far End Cross Talk)
 - i. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
 - j. Propagation Delay
 - k. Delay Skew
 - l. Return loss

3.15 BACKBONE CABLE FIELD QUALITY CONTROL

- A. On completion of the cable installation and termination the cable shall be tested before put into use.
- B. Fiber Optic Cable Testing
 1. Test Equipment:
 - a. Cable tester will be NRTL certified for EIA/TIA TSB95.
 - b. Cable testers will be Optical Power Meter and High Resolution Optical Time Domain Reflectometer (OTDR). The cable tester will be NRTL certified for compliance to latest TIA/EIA Standard 568B performance requirements at 850, 1300 and 1550 nm
 - c. Testers will have been calibrated at least one year prior to use on this project. Contractor to provide proof to Owner if requested
 - d. All testing equipment (OTDR, Light Loss, Splicer etc.) will be owned by the Contractor. Contractor must prove ownership of equipment if requested

2. Cable segments and links will be tested from both ends of the cable for each of the construction phases
3. The system will not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.
4. Test Procedure
 - a. Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths
 - b. Prior to testing, all connectors will be properly cleaned with an approved product manufactured specifically for this purpose
 - c. Prior to beginning testing, confirm that all testing equipment is fully charged or operating on building power. If the test equipment power levels drop below 50%, recharge unit or continue testing with a different (fully charged) tester
 - d. Initially test optical cable with a light source and power meter utilizing procedures as stated in TIA TSB-140, ANSI/TIA/EIA-526-7, ANSI/TIA/EIA-526-14A, OFSTP-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss in installed Single-Mode Fiber cable plant
 - e. Measured results will be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with Optical Time Domain Reflectometer (OTDR) to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Owner
5. Multi-Mode Fiber Optic Cables
 - a. Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Multi-Mode (850 and 1300 nm). This is Tier 1 testing as specified in TIA TSB-140. Test all Multi-Mode strands to ensure they are capable of transmitting 10 Gigabit Ethernet speeds
 - b. The maximum insertion loss measured at 23 degrees C. will be 3.75dB/km @ 850 nm and 1.5 dB/km @ 1300 nm
6. Single-Mode Fiber Optic Cables
 - a. Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Single-Mode fiber (1310 and 1550 nm). This Tier 1 testing as specified in TIA TSB-140.
 - b. Single-mode fibers will be dual wave length and provide attenuated wavelength of the 1310 nm and 1550 nm. 850 nm for single-mode fiber will not be acceptable under any circumstances
7. All cables will be tested after termination using a cable certification tester that contains the test equipment manufacturer's most current version of firmware.
8. Test all fiber optic cable segments end-to-end from the fiber optic backbone patch panel in the Equipment Room to each fiber optic backbone patch panel in each Telecommunications Room.
9. Broken or faulty strands will not be accepted. Any cable not fully functional with all strands usable will be replaced at no cost to the Owner.
10. Upon completion of testing, all connectors will be capped with a product made for that specific function by the connecting hardware manufacturer to prevent the contamination of the fiber from construction debris or other foreign objects
11. Test results will include the following:
 - a. Telecommunications Room number
 - b. Location of fiber pull i.e. (Equipment Room # to Telecom Room #)
 - c. Patch panel # and location
 - d. Connector type

- e. Distance
- f. Wavelength tested
- g. Technician who performed the testing

3.16 OWNER INSTRUCTION AND DEMONSTRATION

- A. Provide a complete review of the project and systems including, but not limited to, the following:
 - 1. Review each Record Drawing (use of typical is acceptable).
 - 2. Note equipment layouts, locations and control points.
 - 3. Review each system.
 - 4. Review system design operation and philosophy.
 - 5. Review alarms and necessary responses.
 - 6. Review standard troubleshooting techniques for each system.
 - 7. Review areas served by equipment.
 - 8. Identify color codes used.
 - 9. Review features and special functions.
 - 10. Review maintenance requirements.
 - 11. Review operation and maintenance manuals.
 - 12. Respond to questions (record questions and answers).
- B. Conduct walking tour of Project and briefly describe function, operation, and maintenance of each component after training described above.

3.17 DOCUMENTATION

- A. Provide written certificate(s) and include a copy with the O&M manuals, indicating that the inspections and tests specified herein have been performed, that Owner Training and Demonstration, and that the installation is in accordance with these specifications. Certificate shall be signed and dated by Contractor.
- B. Publish testing results in book format and electronically and include with Operation and Maintenance Manual.

3.18 CLEANING

- A. Provide final cleaning, protection, and maintain conditions in a manner acceptable to manufacturer, which ensures system being free from damage and deterioration at time of Substantial Completion.
- B. In all telecom room spaces - a thorough sweeping, vacuuming and wet mopping shall be performed on a weekly basis or more frequently as directed by the owner. Cleaning shall include floors, rafters, floor joists, exposed structural members, exposed mechanical/electrical equipment and ductwork/piping/conduits, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, or per manufacturer recommendations.
- C. All non-metallic cable managers and snap covers shall be wiped clean, both inside and outside of front, including rear channels. All clear covers and doors shall be cleaned, both front and rear per manufacturer recommendations.
- D. Inside of fiber optic enclosure and patch panels shall be blown clean of settled dust. Cleaning shall be performed for all new construction projects or where gypsum sanding has been performed.
- E. All scraps, boxes, spools, pull-line and trash shall be removed and properly disposed of.
- F. All residual cable lubricant shall be cleaned from floors and walls with an appropriate degreaser.

3.19 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.

- C. Visual Inspection:
 - 1. Inspect cable jackets for certification markings.
 - 2. Inspect cable terminations for color coded labels of proper type.
 - 3. Inspect outlet plates and patch panels for complete labels.
- D. Testing - Copper Cabling and Associated Equipment:
 - 1. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
- E. Testing - Fiber Optic Cabling:
 - 1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
 - 2. Multimode Backbone: Perform tests in accordance with TIA-526-14.
 - 3. Single Mode Backbone: Perform tests in accordance with TIA-526-7.
 - 4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.
- F. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 27 3000 - ELEVATOR LANDING TWO-WAY COMMUNICATION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. All devices, cabling, equipment, and labor required for a complete and working two-way voice communication system.

RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 26 and 28.

DESCRIPTION OF SYSTEM

- A. Complete fully functional two-way voice communication system including:
 - 1. Vandal resistant and ADA-compliant hands-free speakerphone communications device with a stainless steel faceplate and metal buttons.
 - 2. Command station.
 - 3. Cabling.
 - 4. Testing.
 - 5. Owner training.

QUALITY ASSURANCE:

- A. Warranty: Equipment shall be warrantied against any defects in material and workmanship, under normal use, for a period of twelve months from date of installation. In the event system is found by manufacturer to be defective within the warranty period, manufacturer shall repair and/or replace any defective parts, provided the equipment is returned to manufacturer.

SUBMITTALS FOR REVIEW

- A. Submit according to provisions of Division 01 and Section - Electrical General Requirements.
- B. Provide manufacturer's catalog sheet and technical data sheet for every component of the system.
- C. Provide shop drawings showing one-line diagrams of the overall system. Include wiring schematics.

SUBMITTALS FOR CLOSEOUT

- A. Submit according to provisions of Division 1 and Section 26 0100.

PART 2 PRODUCTS

7.01 EMERGENCY CALL STATION

- A. General Description: Cornell 4200 series. Or prior approved substitution per section 26 0000.
 - 1. The Emergency Phone shall consist of a vandal resistant and ADA-compliant hands-free speakerphone communications device with a stainless steel faceplate and metal buttons.
 - 2. The Emergency Call Station shall have one button labeled "Push for Help" and one 0.375" diameter red light emitting diode (LED) labeled "Call Received When Light Flashes". The unit shall be programmable from a remote location and have a two number dialing capability, reverting to the second number if the first is busy or does not respond. The unit shall be totally hands-free on both sides after connection is initiated at site or by attendant. The unit shall be phone line powered, requiring no outside power source or battery back-up. The unit shall have a dedicated communication line.
- B. Construction: Chassis and face plate shall be constructed of stainless steel or anodized aluminum.

AREA OF RESCUE COMMAND UNIT

- A. General Description: Basis of design: Cornell A-4200. Or prior approved substitution per section 26 0000.
 - 1. The Area of Rescue Assistance (ARA) system shall consist of a Command Unit allowing 4 to 20 zones in increments of 4 zones.
 - 2. System shall provide for dedicated communications lines from Emergency Call Stations to Command Unit.
- B. Construction: Anodized aluminum faceplate with silk-screen designations. Flush mounted in manufacturer provide backbox.
 - 1. Unit shall be protected in a 16-gauge #4 brushed stainless steel cabinet including all necessary components except Strobe/Siren and mounting hardware.
 - 2. Unit shall be contained within an enclosure meant for recessed mounting within a wall.
 - 3. Enclosure shall include two Lexan windows: one revealing handset and operating instructions, the other enabling emergency personnel to monitor the ARA Station LEDs.
 - 4. Unit shall have modular ports for connecting ARA stations, a local phone, a telco line in and a telco line out.
 - 5. Conduit hole knockouts shall be provided on both top and bottom of enclosure.
- C. Command Unit shall include an Uninterruptible Power Supply (UPS), mounted inside or outside of the cabinet, so that system shall function for at least 4 hours of active use during a power outage.
- D. Command Unit shall include one alternate action switch with two internal LED indicators for each zone. An audible alarm on the Annunciator Panel will emit a minimum sound level of 90db at 30cm. A yellow LED light for each zone will illuminate and the alarm will emit a repeating sound if any of the supervised lines are faulted. The panel shall be constructed of anodized aluminum with permanently silk-screened zone designations on the panel as well as a designation strip
- E. Lighting:
 - 1. The command unit has a Red, Green, and Yellow LED per zone to indicate call placed, call answered, and fault respectively. When call is initiated, button must be depressed and then push to talk must be pressed in order to open voice communication.
- F. Electrical
 - 1. Command Unit shall include a UPS to enable operation of system for at least 4 hours in a power failure. UPS shall operate on 120VAC power.
 - 2. ARA Stations, Local Phone, Telco line in and Telco line out shall plug into RJ11 receptacles on Command Unit. All other components shall be plugged into included Power Strip, which in turn is plugged into UPS.
 - 3. Strobe/Siren assembly and its power supply, all relays and power strip shall be UL listed.
- G. Mounting: Flush mount. Conduit hole knock-outs shall be provided in top and bottom of enclosure to allow easy connection between Master Station and ARA Stations, Strobe/Siren and 120VAC power source.

WIRING

- A. Provide wiring as recommended by manufacturer.
- B. Install per NFPA 72 for survivability requirements as identified in part 3. Include a listed 2-hour fire rated cabling assembly as required by NEC.

SIGNAGE

- A. At each equipment location, include permanent signage indicating "Emergency Phone" verbiage and instructions for use per NFPA requirements. Verify signage type, verbiage, and look with Architect during shop drawing process.

PART 3 EXECUTION

11.01 EXAMINATION

- A. Receive, inspect, handle and store equipment in accordance with manufacturer's instructions.
- B. Examine equipment before installation and reject those which are damaged.
- C. Examine location of equipment installation for compliance with installation tolerances and other conditions affecting performance of Work.

PREPARATION

- A. Review shop drawings for cabling and cabling pathway requirements.
- B. Review installation details with manufacturer and SCSU personnel prior to beginning installation.

INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Installation must comply with NFPA 72 requirements for an emergency 2-Way Communication System per NFPA 72.
 - 1. Wiring for two-way communications system shall have a minimum pathway survivability of Level 2 (NFPA 72, section 24.3.5.7 (2010)).
 - 2. Wiring shall consist of a 2-hour fire-rated cable system or be installed within a 2-hour fire-rated enclosure or protected area, or other method described in NFPA 72, section 12.4.2 (2010).
 - 3. Other approved methods described in NFPA 72, section 12.4.2 (2010) shall be acceptable.
 - 4. Install all required signage at locations indicated by the Architect.

FIELD QUALITY CONTROL

- A. Inspection and testing will be performed under provisions of Division 01 and Section - Testing Electrical Systems.
- B. Performance Verification Testing:
 - 1. The completed system shall be tested for proper operation in the presence of the Engineer.
 - 2. The Contractor shall replace defective materials and make required adjustments.

END OF SECTION

SECTION 27 5118 - SOUND MASKING SYSTEMS - CAMBRIDGE

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM E1130 - Standard Test Method for Objective Measurement of Speech Privacy in Open Plan Spaces Using Articulation Index; 2016 (Reapproved 2021).
- B. ASTM E1573 - Standard Test Method for Evaluating Masking Sound in Open Offices Using A-Weighted and One-Third Octave Band Sound Pressure Levels; 2009.
- C. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords; Current Edition, Including All Revisions.
- D. UL 1666 - Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts; 2007-02-16.
- E. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.
- F. UL 2572 - Mass Notification Systems; Current Edition, Including All Revisions.

1.02 SUMMARY

- A. This specification includes all components required for a fully functional Sound Masking System for areas indicated on the drawings.

1.03 DEFINITIONS:

- A. Sound Masking System: The electronic equipment and loudspeakers used to generate, distribute, and control masking sound throughout a treated area.
- B. Loudspeaker or Emitter: These terms are used interchangeably in this document to indicate a device in the Sound Masking System which emits masking sound and voice paging or music.
- C. Zone: One or more Loudspeakers assigned to a Control Module and operating as a group.
- D. Spatial Uniformity: A condition where the sound pressure levels throughout a defined space do not vary significantly from a specified sound pressure level.
- E. Spectral Uniformity: A condition where the sound pressure in each one third octave band, does not vary significantly from the specified one third octave sound pressure level.
- F. Temporal Uniformity: At a given position a condition where the average sound pressure level measured over a short time interval does not differ significantly from the average sound pressure level measured over a long time interval.
- G. SPL: Sound pressure level in dB re 0.00002 Pa (0.0002 microbar).
- H. Project Manager: The architect, owner's representative, general contractor, or other project manager in charge of the construction and site.
- I. Sound Masking System Designer: The person or team responsible for design of the Sound Masking System.
- J. Manufacturer: That company which produces the Sound Masking System products.
- K. Contractor: That company chosen to install the Sound Masking System. Contractor must meet the qualifications described in Section 1.08.
- L. Authorized Dealer: That company chosen to provide all Sound Masking System products described in Part 2. This dealer must be an authorized dealer of Manufacturer's products.

1.04 REFERENCES:

- A. ASTM E1130-08 – Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index.
- B. ASTM E1374-11 – Standard Guide for Open Office Acoustics and Applicable ASTM Standards.

- C. ASTM E2638-10 – Standard test method for objective measurement of the speech privacy provided by a closed room.
- D. ASTM E1573-09 – Standard Test Method for Evaluating Masking Sound in Open Offices Using “A”-Weighted and One-third Octave Band Sound Pressure Levels.
- E. ANSI S1.6 – Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements.
- F. ANSI S1.4 – Specification for Sound Level Meters. Calibrated Type 1 or Type 2.
- G. ANSI S1.11 – Specification for Octave Band and Fractional Octave Band Analog and Digital Filters.
- H. UL 2043 – Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air Handling Spaces.
- I. ISO - International Standards Organization
- J. NEC - National Electrical Code 2017 Edition
- K. CSA-Canadian Standards Association
- L. CE Code – Canadian Electrical Code as Published by the Canadian Standards Association referencing 24th Edition / 2018.

1.05 DESCRIPTION OF WORK

- A. The work of this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of the Sound Masking System and related work for this project, as required by the schedules, and keynotes and drawings.

1.06 FUNCTIONAL REQUIREMENTS OF SYSTEMS:

- A. Distribute sound masking to all areas as indicated on the project drawings.
- B. All active electronic components shall be conveniently accessible for service.
- C. All systems components shall be supplied from a single manufacturer.

1.07 SYSTEM DESIGN, COMMISSIONING AND EQUIPMENT SUPPLY

- A. Sound Masking System Designer shall be:
 - 1. An Authorized Dealer Trained and Certified by the Manufacturer.
- B. Sound Masking System commissioning shall be performed by:
 - 1. An Authorized Dealer Trained and Certified by the Manufacturer.
- C. Equipment and accessories, including such things as cabling where applicable, shall be supplied by a dealer authorized by the equipment manufacturer.

1.08 INSTALLING CONTRACTOR QUALIFICATIONS

- A. Sound Masking System shall be installed by a qualified Contractor.
- B. To be considered qualified for this work, the Contractor must be experienced in the provision of low-voltage electronic systems similar in complexity to those required for this project, and meet the following:
 - 1. The Contractor’s primary business is the provision, fabrication, and installation of integrated audio and video systems including distributed sound systems, structured cabling, and/or related systems in the commercial environment.
 - 2. The Contractor is an authorized dealer for the major product components and is certified by the manufacturer to perform their installation and setup.

1.09 SUBMITTALS FOR REVIEW

- A. Submit according to the requirements of Division 1 and Section – Electrical General Requirements.

- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation methods.
- C. Submit manufacturer prepared floorplan drawings of the system indicating all speaker types, locations, and mounting details, and controller locations. Indicate wiring as required for all separate zones. Provide fully designed zones for coverage of the indicated areas with spacing requirements, housing types, and mounting heights.
- D. Coordinate with the full set of electrical and architectural plans for ceiling types, heights, etc.

1.10 INSTALLATION AND QUALITY ASSURANCE

- A. All equipment, cabling, accessories and associated hardware shall be installed in accordance with manufacturer's instructions and according to standards of good engineering practice and other conditions.
- B. Workmanship shall be of professional quality, best commercial practice, and shall be accomplished by qualified personnel.

1.11 JOB CONDITIONS

- A. Contractor shall refer to and adhere to Division 02 of this Article.
- B. Sequencing and Scheduling:
 - 1. Coordinate work with Construction Manager and other trades to facilitate construction and prevent conflicts.
 - 2. Afford other trades reasonable opportunity for installation of work and for the storage of materials.
 - 3. Staff the job to keep pace with the other trades; otherwise, the Construction Manager will require an increase in force or overtime work without additional expenses to the Owner.
 - 4. Abide by the decision of the Construction Manager in case of conflict or interference by other trades.
 - 5. Refuse: Remove all refuse from the job site to the satisfaction of the Construction Manager and Owner.

1.12 INSPECTION

- A. Notify the Construction Manager of any defects in work by other trades affecting system installation, operation, or performance.

1.13 WARRANTY

- A. Warrant the installation of all equipment, cabling, and labor for an initial period of one year from the date of final acceptance.
- B. Owner requested services, including telephone support, shall be at no charge during the duration of the initial one year warranty period.
- C. During the initial warranty period, services shall include two semi-annual visits to the site for routine adjustment and maintenance of all equipment. Provide a preliminary schedule for the semi-annual visits.
- D. Warrant all equipment to be free of faulty workmanship and defects for a minimum period of five years from date of final acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. The basis of design is Cambridge Sound Management QtPro Direct Field Sound Masking System. Product details available at <https://cambridgesound.com/>
- B. Substitutions by prior approval only

2.02 GENERAL

- A. Product requirements include all masking, signal generation, signal processing, amplification, and loudspeakers with associated wiring, software, and controls.
- B. Only complete, integrated Sound Masking Systems from a sole manufacturer shall be acceptable.
- C. Sound Masking System shall be capable of multiple Zones in order to adjust for unique architectural spaces and facility uses.
- D. The Sound Masking System shall be capable of automatically scheduling system parameter adjustments, including initial acclimatization, on a per Zone basis.
- E. Means of control may be facilitated through any combination of front panel hardware interface, wall mounted controls, and/or web browser based software interface.
- F. Sound Masking System shall be capable of generating, amplifying, and distributing a minimum of four non-correlated sound masking signals on adjacent loudspeakers. Adjacent loudspeaker devices may not reproduce coherent sound masking signals.
- G. Sound Masking System shall be capable of accepting at minimum one external line level audio source from ancillary audio equipment with control on a per Zone basis.
- H. Sound Masking System Zones shall be determined by the functional requirements of each area(s) with separate independent level control for each Zone as indicated by the project documents.
- I. A separate level control Zone shall be required in instances where a change in loudspeaker mounting / ceiling height varies by more than 6" throughout a functional space.

2.03 LOUD SPEAKERS

- A. Provide Cambridge QT Emitter (passive type).
- B. The loudspeakers shall be direct field, radiating directly into the occupied space. Plenum based loudspeaker systems are not acceptable in this specification.
- C. Direct Field loudspeaker drivers shall be less than 3" in diameter and be capable of mounting directly into acoustic ceiling tile materials, surface mounted, pendant mounted, structural beam mounted, or hard surface ceiling mounted utilizing optional manufacturer supplied accessories. Provide seismic rated mounting where required by jurisdiction.
- D. Place loudspeakers where indicated on project drawings. Space evenly as recommended by the product manufacturer based on site conditions and ceiling heights and below finished ceiling obstructions to meet the performance requirements stated in Part 3 of this specification.
- E. Loudspeakers as driven by control processor/module shall be capable of producing minimum sound pressure levels and frequency spectrum as required in Part 3 of this specification and as measured at an above finished floor height of 4ft (1.31 yards) regardless of ceiling type, height, or presence.
- F. Loudspeakers and accessories mounted in air handling spaces shall be UL 2043 compliant.
- G. All loudspeakers shall be remotely powered passive type.
- H. 70-volt / 25 volt or other high-voltage distribution is not allowed in this specification.
- I. Housings
 - 1. Provide housings as necessary for installation of speakers in the ceiling type utilized in the corresponding area. See architectural reflected ceiling plans.
 - 2. In open ceiling areas containing sound baffles, the loudspeakers shall be installed in housings designed for threaded rod mounting to drop the speakers to the level of the bottom of the baffles.
 - 3. Provide surface mounting housings where appropriate.
 - 4. Provide recessed gyp and or ceiling tile mounting. Verify with RCP.

5. Manufacturers system designer shall review all architectural plans, mechanical plans, and electrical plans to indicate the proper housing for each speaker application.

2.04 CONTROL PROCESSOR/MODULES

- A. Provide Cambridge QT 600 sound masking generator.
 1. 6-zone controller with individual zone control for output level.
- B. Provide DSP-based masking sound generation with a minimum of four (4) uncorrelated masking signal outputs per Zone.
- C. Provide a factory default sound masking spectrum as defined in Table 1 - PART 3 of this specification.
- D. Multi-Zone processing shall provide adjustment of the masking level on a per Zone basis with adjustment in .5 dB increments.
- E. Multi-Zone processing shall provide per Zone scheduling function via internal clock source and/or network NTP server, which is capable of adjusting the masking signal levels. Scheduling shall at a minimum adjust for separate weekday and weekend level settings.
- F. Multi-Zone processing shall provide an automatic, incremental level adjustment feature, allowing a gradual, one-time change of masking levels to commence upon completion of system commissioning, acclimating occupants to a newly sound masked environment (initial acclimatization).
- G. Multi-Zone control processor shall be capable of TCP/IP network connectivity via DHCP or Static IP address.
- H. Each masking Zone, when multiple Zones are required, shall be separately capable of one third octave equalization adjustment of the sound masking spectrum as defined in Table 1 - PART 3 of this document. Equalization shall be set at the factory. No field equalization shall be necessary under this specification.
- I. Control Processor shall have at least one line level audio input accepting a nominal signal level of +4dBu. A separate one octave band equalizer, independent from the sound masking equalizer, shall be provided for adjustment of the audio input.
- J. Control Processor shall have the capability to mute or otherwise disable the sound masking signal and minimal one line-level audio input(s) using a dry contact closure from a third party source.
- K. Fault reporting of trouble conditions to cabling and ancillary devices shall be incorporated at the Control Processor level.
- L. Control Processor shall feature a nonvolatile memory, capable of storing all system settings in the case of power disconnect.
- M. System shall include a UL/CUL/CE -listed 120-240VAC 50/60Hz power supply. Remote power supplies when mounted in air handling spaces shall be plenum rated pursuant to local codes and jurisdictions.

2.05 SOFTWARE AND CONTROL

- A. The multi-Zone Sound Masking System shall be capable of software control via a TCP/IP local area network connection to the Owner's local area network (LAN Infrastructure).
- B. Coordinate connection to local area network with Owner's network administrator to include IP Addressing, MAC address, and switch port assignments.
- C. The software interface may consist of one or more of the following types:
 1. Client Based Control - Windows 7/10
 2. Web - Internal web server using browser client
 3. Mobile - Internal web server using browser client or software applications for Apple IOS/ Android OS devices.

- D. Software control of multi-Zone sound masking shall include password-protected adjustment and configuration of the following minimum features to include:
 - 1. Sound masking levels on a per Zone basis.
 - 2. Audio input levels on a per Zone basis.
 - 3. Equalization adjustment on a per Zone basis.
 - 4. Zone naming on a per Zone basis.
 - 5. Time of day scheduling on a per Zone basis.
 - 6. Network / clock management.
 - 7. Three step incremental level adjustment on a per Zone basis.
 - 8. Error notification / monitoring.
- E. A hardware interface will be capable of basic level adjustment on a per Zone basis using the following method.
 - 1. Control Processor Front Panel Menu – A hardware interface that allows, at minimum, operation of both sound masking and audio input levels on a per Zone basis.

2.06 CABLE ASSEMBLIES

- A. All cable assemblies shall consist of the proper number of conductors, wire gauge, and type, as approved by the system manufacturer based on the system design.
- B. Cabling flammability rating shall meet the installation conditions as required by NFPA/NEC/CSA or local codes/ jurisdiction as follows:
 - 1. Type CMP/FT6 – Commercial Installation for plenum airspaces. Meets UL-910 requirements for smoke and flammability testing.
- C. Terminations shall be completed utilizing the appropriate connector type, method, and tooling as recommended by the product manufacturer.
 - 1. Field terminations shall be permitted in cases only where approved by the product manufacturer.
- D. Ethernet cabling shall be as specified in section 271000.
- E. All Emitter cabling shall be a single jacket UTP Category 3, Category 5e, Category 6, or Category 7 cable with 8 conductor TIA/EIA568B modular plug connectors. Cabling shall be white in color. Plenum rated.
- F. Each Ethernet cable shall be verified by the Installing Contractor to 10/100 MB/sec standards.
- G. Factory supplied UTP Category interconnect cables will be utilized whenever feasible based on available cable length.

2.07 LABELS

- A. Except where otherwise specified, label each item of control equipment as shown on drawings or as directed by the Owner.
- B. Identify all wires and cables at every connection point to controllers with reference number keyed to the as-built wiring diagrams.
- C. Room numbers appear on the contract documents for reference only. All labels shall reflect the Owner's final room designations.
- D. Cable Markers:
 - 1. High-grade PVC clip-on or permanent-type cable markers with permanent markings, or printed vinyl tape protected by clear shrink tubing or adhesive wrap.

2.08 SAFETY LISTINGS

- A. General
 - 1. Products and system shall comply with all applicable local, regional and national safety codes.
- B. Electrical Safety

1. All electronics shall be UL Listed or listed by an equivalent body such as Intertek ETL. Outside the USA, the electronics shall be certified by an equivalent certification body to meet local and/or national safety standards.
- C. Seismic Safety
 1. Loudspeaker seismic support must be provided by manufacturer-certified electronic input cable supported by a copy of manufacturer's test report. Alternate seismic support system(s) must be approved by authorities having jurisdiction and based on local code requirements.
- D. Fire Safety
 1. Control Processor shall have the capability to mute or otherwise disable the sound masking signal and any line-level audio input(s) using a dry contact closure from a third party source such as a fire alarm panel.
 2. The Sound Masking System shall not be a primary means of emergency voice evacuation or ECS. For this reason, UL 2572 compliance is not required under this specification.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to installation, ensure the site is suitable for system installation.
- B. Verify all locations where system components are to be installed are free of conflicts with other trades prior to installation.
- C. Verify that site building conditions match the system design plans including ceiling finishes, wall locations, and obstructions. Immediately notify the Project Manager of any discrepancies prior to the commencement of work.
- D. Ensure system power requirements, network connectivity, and any other third party infrastructure requirements for the system have been provided and installed prior to installation.

3.02 DELIVERY, STORAGE AND HANDLING

- A. Protect all system components from moisture, dust and damage during shipping, storage and handling.
- B. Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels legible and intact.
- C. Inspect all system components upon receipt and upon unpacking.

3.03 INSTALLATION

- A. General
 1. Comply with all applicable electrical and other safety codes.
 2. Install Sound Masking System in compliance with manufacturer's recommendations and published documentation.
 3. All equipment shall be installed by competent workers at locations shown on the drawings in strict accordance with approved shop drawings. Record any and all necessary changes to the system design in cases where different from the submittal documents.
 4. All equipment shall be firmly held in place including loudspeakers, enclosures, amplifiers, processors, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least six unless otherwise stated.
 5. All system components shall be mounted in a level and plumb fashion utilizing the dimensions indicated on the associated drawings.
 6. User controllable devices shall be mounted at a location and height which allows for normal adjustment and operation.
 7. Electronics shall be conveniently accessible for service.
 8. Above-ceiling inline power injector equipment shall be UL 2043 rated for air handling environments.

9. Systems using above-ceiling sound masking generators are not permitted under this specification.
- B. Loudspeakers
1. Locate loudspeaker assemblies as indicated on project drawings and as required to meet the spatial uniformity requirements of this specification.
 2. Loudspeakers must be installed no more than 21 feet above the floor.
 3. Ensure loudspeaker coverage pattern is not obstructed by building systems or structures which may impede performance of the Sound Masking System.
 4. Ensure minimum distance between the top of loudspeaker and structure/obstacles are maintained to allow adequate clearance of cabling and connectors.
 5. When mounted in other substrates, ceiling types and or building structures, loudspeakers shall be installed using manufacturer supplied accessories. Mount loudspeaker assemblies to structure in an approved method as required by local codes and jurisdiction, and indicated by the project submittals.
 6. Follow manufacturer recommendations for individual loudspeaker level controls/taps. Adjust as necessary.
- C. Housings
1. Provide housings as necessary for installation of speakers in the ceiling type utilized in the corresponding area. See architectural reflected ceiling plans.
 2. Provide recessed housings with flush trim ring in gyp and ceiling tile installation locations.
 3. In open ceiling areas containing sound baffles, the loudspeakers shall be installed in housings designed for threaded rod mounting to drop the speakers to the level of the bottom of the baffles.
 4. Provide surface mounting housings where appropriate.
 5. Manufacturers system designer shall review all architectural plans, mechanical plans, and electrical plans to indicate the proper housing for each speaker application.
- D. Cabling
1. All cable installation shall be done in professional workmanlike manner with adequate service loops where applicable. Dress cabling in a neat and consistent fashion using appropriate methods and materials.
 2. Test all field fabricated and manufacturer supplied cables, before installation, for open circuits, shorts, crossed pairs, reversed pairs, split pairs and proper pin-out.
 3. Refer to manufacturer recommendations as to maximum cabling distances and types to support control processor unit(s), controls, and loudspeakers. Never exceed manufacturer's cable distance limitations and quantity of devices per cable run.
 4. Cabling pathways shall be configured to prevent conflict with other building systems. Care should be taken to minimize and eliminate all RFI and EMI interference sources.
 5. Maintain appropriate separation between dissimilar signal types, voltages, and electrical devices.
 6. Cabling to be installed/supported in a manner and frequency utilizing approved methods and materials as required by the local AHJ (authority having jurisdiction).
 7. Cabling shall be installed in metallic rigid or flex conduit only as indicated on the associate project drawings/ specification and using manufacturer approved accessories.
 8. All cabling shall be supported from structure. Cabling shall not contact ceiling tiles or inhibit their removal for access to the plenum.
 9. Cabling shall be plenum rated.
 10. Cabling shall be installed in cable tray wherever possible.
 11. For concealed, accessible ceiling applications, provide non-continuous cable supports to support the wiring per section Pathways for Communications Systems. For non-accessible or exposed ceiling areas, all wiring must be installed in conduit up to the base of the emitter housing/support.

3.04 SITE QUALITY CONTROL

- A. Ensure that loudspeaker spacing is correct, consistent, and follows design guidelines set forth by the product manufacturer.
- B. Securely terminate all cables.

3.05 SYSTEM STARTUP

- A. Coordinate with building network administrator for an Ethernet connection to building LAN where required.
- B. Perform the entire product manufacture's recommended testing and startup procedure as outlined in the manufacturer's product manual(s).
- C. Ensure functional operation of all ancillary devices to include front panel controls, audio inputs, contact closures, wall controls, software control and third party controllers. Test each setting and confirm expected results from actions taken. Correct all deficiencies in operation.
- D. Perform system startup at a time when each Zone / space is completely vacant and free of any noise contamination.

3.06 SYSTEM TESTS AND ADJUSTMENTS

- A. Qualifications of Testing Party
 - 1. Testing, calibration and setup shall be performed by a qualified manufacturer's employee or an authorized dealer or consultant who has been trained by the manufacturer.
- B. Prior to Test and Adjustment: Ensure the site conditions are suitable for adjustment of the Sound Masking System. Adjustment can only be made when the following site conditions exist:
 - 1. All ceiling assemblies are currently installed and completed.
 - 2. All interior furnishings are assembled and in place.
 - 3. Mechanical systems have been previously optimized to final operational conditions and are active in areas served by sound masking signals.
 - 4. No occupants are present at the time of adjustment.
 - 5. External noise sources (i.e. construction activities) are not present during testing.
 - 6. Final testing shall be scheduled at least 30 days in advance of owner occupancy.
 - a. Notify the Construction Manager of the testing and adjustment schedule.
- C. Initial Test and Adjustments: Perform and record results of the following tests:
 - 1. Loudspeaker Operation: Near field output of each loudspeaker shall match the Zone average within +/- 1.5 dB. Listen directly below each installed loudspeaker to confirm it is operating. For any loudspeakers found to be inoperative, or possibly operating at an incorrect level, use a calibrated sound level meter set to A-weighting and slow response to check the output. Place the microphone so as to contact each grille and measure the variation between a minimum of 2 adjacent loudspeakers of the same zone.
 - 2. Replace any defective loudspeakers or cabling, or otherwise correct cause for any loudspeakers found to be operating outside the range stated.
 - 3. Buzzes, Rattles, and Distortion: With system operating at maximum level, listen for any buzzes, rattles, and objectionable distortion in all areas covered. Correct all causes of these defects.
- D. Final Test and Adjustment: Perform and record the results of the following tests:
 - 1. Control Settings: Adjust all masking spectrum levels and audio level controls for initial operation using manufacturer recommended procedures. Document setting for each user control.
 - 2. Adjustment of Audio Input Levels: Adjust background music/paging levels for clarity above ambient noises with a minimum signal to noise ratio of 10 dBA above ambient sound levels. Adjust frequency spectrum of each input as necessary to achieve accurate reproduction of the intended signal source.

3. Adjustment of Sound Masking Levels: With the masking system active, measure the A-weighted sound pressure level of each Zone independently. Use an ANSI S1.4 approved and calibrated Type 1 or 2 sound level meter and/or calibrated real time acoustic analyzer with 1/3 octave filters per ANSI S1.11. Perform all SPL measurements at a typical seated height of 4ft AFF (1.31 yards). Adjust the sound masking frequency spectrum in each Zone to correspond with the A weighted average level and frequency levels (non-weighted) shown in Table 1. Document at minimum, one measurement per 1000sq ft. in open offices, one measurement in 50% of private offices, and one measurement in 50% of all other spaces where sound masking is present. All documented measurements shall meet the maximum level variation column criteria of Table 1. Correct any Sound Masking System deficiencies such as loudspeaker placement or loudspeaker tap settings to meet this performance criteria.

TABLE 1

FREQUENCY	OPEN OFFICE	PRIVATE OFFICE	CORRIDOR / CONFERENCE ROOM	MAX VARIATION
*125 HZ	48 DB	43 DB	46 DB	+/- 3DB
*160 HZ	47 DB	42 DB	45 DB	+/- 3DB
200 HZ	45 DB	40 DB	43 DB	+/- 3DB
250 HZ	44 DB	39 DB	42 DB	+/- 2DB
315 HZ	42 DB	37 DB	40 DB	+/- 1DB
400 HZ	41 DB	36 DB	39 DB	+/- 1DB
500 HZ	40 DB	35 DB	38 DB	+/- 1DB
630 HZ	39 DB	34 DB	37 DB	+/- 1DB
800 HZ	38 DB	33 DB	36 DB	+/- 1DB
1000 HZ	37 DB	32 DB	35 DB	+/- 1DB
1250 HZ	36 DB	31 DB	34 DB	+/- 1DB
1600 HZ	34 DB	29 DB	32 DB	+/- 1DB
2000 HZ	32 DB	27 DB	30 DB	+/- 1DB
2500 HZ	30 DB	25 DB	28 DB	+/- 1DB
3150 HZ	27 DB	22 DB	25 DB	+/- 1DB
4000 HZ	24 DB	19 DB	21 DB	+/- 1DB
5000 HZ	19 DB	14 DB	17 DB	+/- 1DB
*6300 HZ	14 DB	9 DB	12 DB	+/- 1DB
*8000 HZ	11 DB	6 DB	9 DB	+/- 1DB
AVERAGE "A" WEIGHTED SOUND PRESSURE LEVEL (DB A)	47 DBA	42 DBA	45 DBA	+/- 2 DBA

*** DENOTES ADDITIONAL FREQUENCY BANDS TO BE USED WHEN SPECIFYING ACTIVE (SELF-POWERED) DIRECT-FIELD LOUDSPEAKERS.**

1. Configure time of day sound masking level adjustment following the final adjustment of sound masking levels. Coordinate with Owner to determine activity times and levels of occupancy. Adjust the Sound Masking System based on the target "Average A-Weighted Sound Pressure Level" in Table 1 as the final sound masking levels used for high activity/occupancy times. Adjust the Sound Masking System based on the targeted

- “Average A-Weighted Sound Pressure Level” in Table 1 with adjustment -3 to -9 dBA lower at times of inactivity/lower occupancy per product manufacturer’s recommendations.
2. When integrating the Sound Masking System in a space previously occupied by workers, configure the incremental level adjustment feature of the control processor. Following the initial adjustment of sound masking levels, adjust each Zone’s initial sound masking level to a level 1.5 dBA above the average ambient noise level of the space. Engage the incremental level adjustment feature to automatically increase the sound masking level until reaching the “Average A-Weighted Sound Pressure Level shown in Table 1 for each type of space listed. Use a minimum time frame of five days for the incremental level adjustment to reach the final target levels.
 3. Provide a final testing report which states that the performance requirements of the Sound Masking System have been met.

5.02 CLEANING AND WASTE MANAGEMENT

- A. Remove empty packaging and other material waste.
- B. Clean all debris created by installation of components.
- C. Clean system components where required.

5.03 FINAL CLOSEOUT AND AS-BUILT DOCUMENTATION

- A. The Contractor shall document, prepare and submit all final control processor settings, loudspeaker Zone maps, loudspeaker tap settings, one line diagrams, operational instruction, and testing results in PDF format. Submit with the Operation and Maintenance Manuals per section Electrical Systems Closeout Documents.

5.04 TRAINING

- A. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of all systems, software, and equipment. Explain operation of control systems, set-up and operation of individual pieces of equipment, and functions of overall systems.
- B. Provide manufacturer’s operation manuals for all products used in the system.
- C. Provide an overall system operation manual for use by the Owner’s maintenance personnel.
- D. Train Owner’s designated representative on Sound Masking System maintenance and proper operation.
 1. Provide User Instruction on Operation
 2. Discuss potential for mis-adjustment of sound masking levels and deterioration of both comfort / speech privacy performance.
 3. Demonstrate all software features, controls, and configuration.

END OF SECTION

SECTION 28 0000 - ELECTRONIC SAFETY AND SECURITY GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical General Requirements specifically applicable to Division 28 Sections, in addition to Division 01 - General Requirements.
- B. Definitions common to Division 28 specification sections.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 28.
- B. This section is related to all other sections of Division 28.

1.03 DEFINITIONS

- A. Words "Architect" where written in Division 28 specifications and drawings refer to commissioned Design Professional, whose name appears on contract documents.
- B. Word "Engineer" where written in Division 28 specifications and drawings refers to Consulting Electrical Engineer, Obermiller Nelson Engineering, Inc., 311 Fourth Street South, Suite #110, Grand Forks, ND, 58201; phone (701)775-2594, facsimile (701)775-0231.
- C. Word "Contractor" where written in Division 28 specifications and drawings refers to Electrical Contractor and any and all of his subcontractors.
- D. Word "Material" where written in Division 28, specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.
- E. Word "Labor" where written in Division 28 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.
- F. Word "Provide" where written in Division 28 specifications and drawings shall mean "Electrical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".
- G. Performance Verification Testing refers to test performed in the field to ensure proper operation and / or installation of service or products.
 - 1. Unless noted otherwise Performance Verification Testing is not required to be provided by a 3rd party testing firm.
 - 2. Unless noted otherwise Performance Verification Testing is not required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent
- H. Acceptance Testing refers to formal testing process required prior to acceptance by the Owner.
 - 1. Unless noted otherwise Acceptance Testing is required to be provided by a 3rd party testing firm.
 - 2. Unless noted otherwise Acceptance Testing is required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent.
- I. As-built drawings are prepared by the contractor. They show, in red ink, on-site changes to the original construction documents.
- J. Record drawings are prepared by the Architect or Engineer and reflect on-site changes the contractor noted in the as-built drawings.
- K. Quality Assurance includes all the planned and systematic activities implemented that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality.

Typically, quality assurance procedures are performed before and while the work is being performed. As such in the Division 28 specifications Quality Assurance procedures are specified in Part 1.

- L. Quality Control includes all the planned activities required to verify quality after the work has been performed. This can include testing and inspections along with other procedures. As such in the Division 28 specifications Quality Assurance procedures are specified in Part 3.

1.04 SCOPE OF WORK

- A. All Specifications, corresponding Drawings and all Addenda form a complete set of documents for electrical work for this project, and no part shall be considered complete without the other.
- B. The Specifications, Drawings, and all Addenda describe both the design characteristics and functional performance criteria that the completed electronic safety and security systems shall include.
- C. Contractor shall obtain all required licenses, permits, plan reviews, inspections and pay all fees, costs and all other charges for this project. All sales, use and any other taxes shall be paid by Contractor.
- D. Electrical Work shall comply with all ordinances, laws, regulations and codes applicable to the work involved. If, in any instance, the plans and specifications conflict with such laws, the stricter requirement shall take preference.
- E. If Contractor is aware of conflicts between drawings or specifications and such codes or regulations, they shall be brought to the Engineer's attention prior to commencing work. If Contractor performs work in violation of such codes or regulations, Contractor shall correct the violation at his expense.
- F. Work under Division 28 includes providing all labor and materials necessary for satisfactory completion of all electrical work shown on all drawings and in all specification divisions. In general, this consists of the following:
 - 1. Supervisory control and telemetry.
 - 2. Electronic Safety and Security Systems.
 - 3. Other systems specified, indicated, or shown.
- G. Site Investigation
 - 1. Prior to submitting bids, visit the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.
 - 2. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions.
 - 3. Where work under this project requires extension, relocation, or modifications to existing equipment, systems or installations the existing equipment, system or installations shall be restored to their original condition, with exception to the work under this project, before completion.
 - 4. Existing equipment, systems and installations which are not detailed on the drawings must still be restored to their original condition.

1.05 DRAWINGS

- A. Drawings indicate the extent and general layout of the Electronic Safety and Security systems.
- B. The electrical drawings are diagrammatic (that is, designed to demonstrate or explain the scope of work), they are intended to be as accurate as planning can determine.
- C. The scales are shown for estimating purposes only. Field verification of dimensions, locations, and construction details is required. Review appropriate drawings (for example: shop drawings), make field measurements and adjust work to suit the conditions encountered.

Although electrical drawings are diagrammatic, they shall be followed as closely as actual construction permits.

- D. Contractor shall coordinate with civil, architectural, structural, and mechanical construction drawings for locations of partitions, walls, beams, shafts, equipment, etc.
- E. DO NOT SCALE LOCATIONS OF DEVICES FROM ELECTRICAL DRAWINGS.
- F. Standard electrical symbols along with special symbols are used on all drawings.

1.06 REGULATORY REQUIREMENTS

- A. SPEC WRITER NOTE: Coordinate this code information with the Architect. The Architect should perform and provide us with a Code Study indicating which codes apply to this jurisdiction.
- B. Work provided shall comply with the following partial list of governing codes and regulations:
 - 1. International Building Code (IBC).
 - 2. International Fire Code. (IFC).
 - 3. State Fire Codes.
 - 4. State and Local Electric Codes.
 - 5. State Building Code.
 - 6. Serving Utility Regulations.
 - 7. National Fire Protection Association (NFPA) National Fire Codes.
 - a. NFPA 70 - National Electrical Code.
 - b. NFPA 72 - National Fire Alarm and Signaling Code.
 - c. NFPA 101 - Life Safety Code.
 - 8. Williams-Steiger (OSHA) Regulations.
 - 9. Americans with Disabilities Act (ADA) requirements.

1.07 QUALITY ASSURANCE

- A. Notify the Architect or Engineer of any discrepancies in or omissions from the drawings and documents. Interpretations and clarifications during bidding will be made only by written Addenda. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality, and appropriate adjustment will be made after contract award.
- B. Any work not clear to Contractor shall be referred to Architect or Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work, in question, as directed by Architect or Engineer, whose decision shall be final, without additional charges.
- C. By virtue of submitting a bid, Contractor agrees that he is skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that he has carefully reviewed all drawings, all specifications and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.
- D. Should major changes from drawings and specification be necessary, Contractor shall provide notification and secure written approval and agreement concerning such changes before work is started.

1.08 WARRANTY

- A. The Electrical Safety and Security Contractor shall guarantee that all materials and equipment included in their work are free of defects caused by flawed workmanship, material or equipment failures.
- B. The warranty guarantee shall extend one year minimum from the date of final acceptance of the work or for as long as normal equipment manufacturer warranties are in effect from the date of final acceptance of the work.

- C. During the warranty period, the Electrical Safety and Security Contractor shall respond by making appropriate corrections or repairs required to correct defect within one week of notification. Notification shall be made by telephone, fax, email, or letter.
- D. The Electrical Safety and Security Contractor shall provide 24-hour service in case of emergency.

1.09 SUBSTITUTIONS

- A. Where substitute materials or prior approved materials are provided, Contractor shall assume all responsibility and pay for all necessary changes resulting from such substitution. This responsibility shall also include any extra costs required by other trades.
- B. Required where specifically noted or where materials are specifically identified by a manufacturer's name, model or catalog number. In these cases only such material may be included in base bid. Prior approval of substitute materials shall be required.
- C. Prior approved substitutions:
 - 1. Requests for prior approval shall be made in accordance with Division 01, as specified below, and indicated in specific specification section.
 - 2. If Contractor desires to furnish materials other than that named, Contractor or supplier shall apply in writing, to Architect, for prior approval of such material at least ten (10) days prior to bid opening date.
 - 3. Requests for prior approved substitution shall indicate specific proposed materials in lieu of those specified together with complete technical data for all such proposed material.
 - 4. All prior approved substitutions will be clearly identified in addenda which will be sent to all bidders well in advance of bid opening. Only material listed on drawings, specifications and addenda shall be provided.
- D. Substitutions after execution of contract: Substitution of materials other than those specifically named in contract documents will be approved, by Architect or Engineer, for following reason only:
 - 1. That material proposed for substitution is equal to or superior, in Engineer and Architect's opinion, to that specified in construction, efficiency, appearance, and utility.
 - 2. That material named in the documents cannot be delivered to project in time to complete work due to conditions beyond control of Contractor.
- E. Equal To and Or Equal: Where materials are specifically identified as "equal to" an identified manufacturer's name, model, or catalogue numbers or where noted as "or equal" manufacturer's complying with the requirements of these specifications not listed may be incorporated in the Work. Such materials must be equal to or superior, in Engineer's opinion, to that specified in construction, efficiency, appearance, and utility.

1.10 GENERAL REQUIREMENTS FOR SUBMITTALS

- A. Submit according to the requirements of Division 01.
- B. General requirements for Submittals for Review
 - 1. Submittal format, general information, and requirements for all submittals:
 - a. At the front of the submittal on a dedicated page(s): name, address, and phone number of equipment vendor, engineer, and contractor.
 - b. At the front of the submittal on dedicated page(s): Any deviation from contract requirements shall be called to attention. No deviation will be permitted without written approval of Architect or Engineer.
 - c. At the front of the submittal on dedicated page(s): Any requests for clarification, selections that must be made, etc. shall be called to attention.
 - d. At the front of the submittal on a dedicated page(s): Include a complete list of equipment included with manufacturer and model number or catalog number.

- e. Submittals shall be grouped to include complete information for related systems, products, and accessories in a single submittal with tabs, dividers, or other means of separating each different component within the submittal from the next.
 - f. Mark dimensions and values in units to match those specified.
 - g. Drawings and brochures shall be clearly marked as to item to be supplied and shall have designation corresponding to designation on Drawings (for example: enclosed switch data shall indicate for which equipment they are provided).
2. Contractor Review of Submittals
- a. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to issuing submittal. Each submittal set shall be stamped, signed and dated indicating Contractor review. If the Contractor fails to properly review submittals, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.
 - b. Should the contractor fail to comply with any of the requirements of the specified submittal requirements; then the right is reserved by the Architect or Engineer to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect and / or Engineer, shall be used in the work at no additional cost to the Owner.
3. Architect / Engineer Review of Submittals
- a. The submittal will be reviewed with reasonable promptness, and returned to the Contractor (with copies retained by the Engineer and the Architect). No equipment should be released for shipment until submittals have been approved.
 - b. Submittal review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required.
 - c. Approval Stamp: Submittals will be reviewed with the following actions noted:
 - 1) "No Exception Taken" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation.
 - 2) "Reviewed as Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
 - 3) "Revise and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at his discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
 - 4) "Rejected" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required and fabrication or procurement is not authorized.
4. If the Architect or Engineer rejects (Revise and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews (beyond the first two) at a rate of \$500 per review. Compensation will be incorporated by Change Order and will be deducted from the Contractor's application for payment. Contractor is responsible for all delays caused by the resubmittal process

- C. General Requirements for Submittals For Information
 - 1. Information submittals shall include the information noted in the specifications and information requested by the Architect, Engineer, and / or Owner.
 - 2. Coordination Drawings: Where this and other specification sections require Coordination Drawings to be submitted meet the requirements defined in Division 01 and as indicated below.
 - a. Prepare documents using software program required by Division 01. If no requirements are listed utilize a software compatible with AutoDesk's AutoCAD.
 - b. Submit hardcopies and / or electronic copies as required by Division 01. Drawings and files shall be uniquely labeled.
 - c. Scale shall not be less than 1/8" equal 1 foot.
- D. General Requirements for Submittals for Closeout:
 - 1. As specified in Division 01 and Section 28 0100.
- E. General Requirements for Product Data. The following are minimum requirements.
 - 1. Catalog sheets showing ratings, settings, performance curves and rated capacities.
 - 2. Dimensions, locations, materials, fabrication details, finish.
 - 3. Outline and support, arrangement and sizes, roughing-in data, and accessories.
 - 4. Operational Characteristics.
- F. General Requirements for Shop Drawings. The following are minimum requirements.
 - 1. Electrical ratings of equipment; how the components of the equipment are assembled and function together; and how they will be installed on the project.
 - 2. Dimensioned plans, elevations, sections, and details. Show quantities of installed devices, features, and ratings.
 - 3. Detail enclosure types.
 - 4. Detail configuration, current, and voltage ratings.
 - 5. Detail features, characteristics, ratings, and factory settings devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.
- G. General Requirements for Manufacturer's Instructions. The following are minimum requirements.
 - 1. Application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
 - 3. Instructions for placing each piece of equipment and system into operation.

1.11 PROJECT SUBCONTRACTOR AND VALUES LISTING

- A. SPEC WRITER NOTE: This is in the spec so that we can get information from the contractor as to who is supplying materials and, who they are using for fire alarm, etc. We do not often enforce it or ask for this information but it is here if we need it.
- B. Contractor shall submit, to Architect, a list indicating brands of all major materials, names of all of his subcontractors and a schedule of values for this project. Engineer reserves right to reject any material or subcontractor and question scheduled values.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 28 0100 - ELECTRONIC SAFETY AND SECURITY SYSTEMS CLOSE OUT DOCUMENTATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Operations and Maintenance Manuals.
- B. Warranty Documentation.
- C. Maintenance Materials.
- D. As-Built Drawings.

1.02 RELATED DOCUMENTS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 28.
- B. This section is related to all other sections of Division 28.

1.03 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Division 01 and Section - Electrical General Requirements.
- B. Provide operations and maintenance manuals and As-Built drawings.

1.04 SUBMITTALS FOR CLOSEOUT

- A. Provide all documents as described below and in each specification section according to the requirements of Division 01 upon reaching substantial completion of the project unless noted otherwise.

PART 2 PRODUCTS

2.01 OPERATIONS AND MAINTENANCE MANUALS

- A. Bind operations and maintenance manual for electrical system in a hard-back binder.
- B. Provide dedicated manuals for the following:
 - 1. Division 28 fire alarm systems.
 - 2. Division 28 video surveillance systems.
 - 3. Division 28 access control system.
- C. Common Results for Operation and Maintenance Manuals. The following information shall apply to all manuals.
 - 1. Provide a master index at the beginning of manual indicating items included.
 - 2. The first section of each manual shall list the name, address, and phone number of Architect, Electrical Engineer, Contractor, and all associated Subcontractors.
 - 3. Each section shall include an approved and edited copy of submittals for review with review comments.
 - 4. Warranty information shall be provided with each piece and / or type of equipment include Manufacturer's Warranty Statement.
 - 5. Testing Reports shall comply with the requirements of Section - Testing of Electrical Systems.
- D. Front cover of each binder shall have the following lettering done in silk screen:
 - 1. ***NAME OF SYSTEM***
 - 2. OPERATION AND MAINTENANCE MANUAL
 - 3. FOR
 - 4. PROJECT NAME, PROJECT LOCATION

- E. The Division 28 Fire Alarm and Detection System manual shall include the following sections with dividers between each section and tabs to separate each device with each divided section. See the applicable sections of the Division 28 specifications for additional information.
1. Equipment and component operation and service manual for each make and model of equipment provided.
 2. System operation manual shall be produced for this specific project. Manual shall detail procedures necessary to activate each system. Provide a simple user guide for procedures necessary to place the system into operation.
 3. Receipts for Spare Materials, Owner Training / Demonstrations.
 4. Test Reports and Certificates.
 5. Operation and Maintenance Guidelines.
 6. Manufacturer's warranty statement.
 7. Contractor's Warranty Statement according to the requirements of specification "Electrical General Requirements."

2.02 AS-BUILT DRAWINGS

- A. The contractor shall maintain one set of drawings at the job site to be used as a master copy. All changes and deviations shall be clearly marked and noted by colored pencil. These drawings shall be turned over to the Architect upon project completion.
1. The following should be edited for each product.
- B. As-Built Drawings shall include the following information in addition to specific information indicated in individual specification sections:
1. Actual locations / configurations of components and equipment.
 2. Indicate route and location of all underground circuits, raceways, pull boxes, etc.
 3. Indicate actual locations and mounting heights of boxes used for electronic safety and security, raceway, and wireway.
 4. Indication of final locations of all fire alarm system components and devices.
 5. Indication of final location of all door access control system components and devices.
 6. Indication of final location of all intrusion detection system components and devices.
 7. Indication of final location of all video surveillance system components and devices.
- C. Indicate other information specifically noted in other Division 28 specification sections.

2.03 MAINTENANCE MATERIALS

- A. Turn over to owner and obtain signed receipt for all maintenance materials, spare parts, touched up parts and loose items.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 28 0500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope general construction materials and methods for application with electronic safety and security systems installations.
- B. Materials specified herein include:
 - 1. Miscellaneous for support of electrical materials and equipment.
 - 2. Hangers and Supports.
 - 3. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in walls, floors, ceilings, roofs, foundations for moisture, water, smoke, fire and acoustic control.
- C. General electric construction methods and requirements specified herein include:
 - 1. Material and workmanship.
 - 2. Product manufacturer requirements.
 - 3. Coordination.
 - 4. Safety.
 - 5. Material handling, storage protection, cleaning and painting.
 - 6. Cutting, patching and finishing.
 - 7. Penetrations.
 - 8. Wiring Methods.
 - 9. System Interruptions.
 - 10. Outlet mounting heights.
 - 11. Equipment Wiring (connections).
- D. Owner Instruction and Demonstration.

1.02 REGULATORY REQUIREMENTS

- A. See Section 28 0000.

1.03 COMMON REQUIREMENTS FOR QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.
- B. Installer Qualifications: Engage experienced Installers for Work.
- C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- D. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide UL Labeled and listed access door assembly with flush door, frame, hinge, and latch from manufacturer listing in the UL "Building Materials Directory" for rating shown.
- E. Standardization of Product Manufacturer:
 - 1. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.
 - 2. Except as noted, all safety switches, and equipment shall be manufactured by the same company, all finishes shall be the same color, and all equipment shall fit the space designated.

3. Wiring devices and other items covered under a single specification section, shall be of the same manufacturer and style whenever practical or where failure to do so is visibly noticeable.
- F. Material and Workmanship:
1. All materials provided shall be new and shall be approved by the Underwriters Laboratories, Inc., NFPA, NEMA, and ANSI as conforming to its standards in every case where such a standard has been established for such material.
 2. Materials shall be standard products of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.
 3. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
 4. All workmanship shall be neat and complete in both effectiveness and appearance and shall be executed by persons licensed and skilled in the trade. Engineer reserves the right to reject any material or workmanship before, during or after construction.
 5. Materials and Finishes: Provide adequate corrosion resistance to eliminate staining of exposed surfaces.
 6. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- G. Coordination:
1. See also "Quality Assurance" paragraph of Section 28 0000.
 2. Discrepancies and omissions discovered during construction shall immediately be called to the attention of the Architect or Engineer for clarification.
 3. Installation of materials shall be coordinated with other trades and installed at such time and manner as to not delay or interfere with the work of other trades.
 4. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections. Determine connection locations and requirements.
 5. Sequence and coordinate work with other trades so as to avoid conflict of space and time sequence. If interference develops, the matter shall be brought to the attention of the Architect for decision.
 6. Organize the work so that progress of work will conform to the progress of other trades. Give particular attention to large equipment requiring positioning prior to closing the building.
 7. Complete the entire installation as soon as building conditions permit.
 8. This Contractor shall be held solely responsible for coordinating proper size and location of hangers, slots, chases, openings, etc., required for proper installation of his work and shall arrange with the proper building contractors for inserts, chases, and openings.
 9. Refer to drawings and specifications of all other divisions and trades for correlating information, location and details of work, dimensions, etc. Coordinate location of all equipment. If conflicts develop Architect or Engineer's decision will govern. No additional compensation will be allowed for moving of un-coordinated, misplaced or poorly located material, equipment or work.
- H. Pre-installation meetings are required as noted in this and other specification sections and are intended to help coordination efforts. Electronic Safety and Security Contractor shall schedule and convene a pre-installation meeting with all affected trades as noted in specifications and on Drawings.
- I. Provide competent representative(s) on site constantly to supervise work from beginning through completion and final acceptance. So far as possible contractor shall keep same foreman and workmen throughout project duration.

- J. During its progress, the work shall be subject to observation by representatives of Owner, Architect and Engineer at which times Contractor shall furnish all required information and cooperation

1.04 SAFETY

- A. Comply with the requirements of Division 01 and this specification.
- B. Perform work in accordance with NFPA 70E and in compliance with OSHA requirements.
- C. Do not perform work on exposed live electrical equipment. If work is required (as defined by OSHA 29 CFR 1910.333) to be performed on exposed live electrical equipment an energized work permit must be must be prepared (see NFPA 70E for energized work permit requirements) and a Hazard/Risk Analysis in accordance with NFPA 70E and provide appropriate levels of personal protective equipment according to NFPA 70E.
- D. Only Qualified Persons as defined by NFPA 70E shall be allowed to work on exposed live electrical equipment. Observe the safety boundaries defined in NFPA 70E.
- E. Prior to performing work on exposed live electrical equipment convene a safety meeting to address safety hazards specific to the task.
- F. Safety Program: the electrical contractor shall implement and document an electrical safety program in accordance with NFPA 70E and a workplace safety program that complies with the requirements OSHA and NFPA 70E.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Manufacturers
 - a. RACO.
 - b. Appelton
 - c. Caddy
 - d. B-Line
 - e. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements.
 - 2. Concrete Structural Elements: Use precast insert system, expansion anchors, powder actuated anchors and preset inserts.
 - 3. Steel Structural Elements: Use beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 4. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 5. Hollow Masonry and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 6. Solid Masonry Walls: Use expansion anchors and preset inserts.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.
- B. Steel Channel:
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.
 - b. Unistrut ®.
 - c. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements.
 - 2. Description:
 - a. Hot dip galvanized where located outdoors and in wet/damp locations.
 - b. Painted steel indoors in dry locations.
 - c. Paint cut ends of channel in damp locations.
 - d. Stainless steel or nonmetallic channel as shown on plans.

- C. Powder Activated Anchors: Remington. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements.
- D. Spring Steel Clips:
 - 1. Caddy
 - 2. Steel City
 - 3. Substitutions: Under provisions of Division 01 and Section - Electrical General Requirements
- E. Miscellaneous Metals:
 - 1. Steel plates, shapes, bars, and bar grating: ASTM A 36.
 - 2. Cold-Formed Steel Tubing: ASTM A 500.
 - 3. Hot-Rolled Steel Tubing: ASTM A 501.
 - 4. Steel Pipe: ASTM A 53, Schedule 40, welded.
 - 5. Nonshrink, Nonmetallic Grout: Premixed, factory-packed, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
 - 6. Fasteners: Zinc-coated, type, grade, and class as required.
- F. Miscellaneous Lumber:
 - 1. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
 - 2. Construction Panels: Plywood backboards; APA A-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 3/4 inches.

2.02 JOINT SEALERS

- A. General: Joint sealers, joint fill material, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Project engineer from manufacturer's standard colors.
- C. Provide fire resistant joint sealers as specified in Division 07.
 - 1. Use the following paragraph only if the Architect does not have products specified in division 07.
- D. Fire-Resistant Joint Sealers: One-part or two-part, foamed-in-place, sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, ducts and through penetrations through fire-rated walls, ceilings, roofs and floors. Sealants and accessories shall have required fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.03 SLEEVES

- A. Sleeves for Raceways and Cables
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized Steel.
 - 2. Rectangular Sleeves: Galvanized Sheet Steel. 16 Gauge for less than 50 square inches and not side longer than 16 inches. 8 gauge for greater than 16 inches or one side more than 16 inches.
- B. Sleeve Seals
 - 1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.

- b. Calpico, Inc.
- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.
- e. Link Seal.
- 3. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
- 4. Pressure Plates: Carbon steel. Include two for each sealing element.
- 5. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element
- 6. Provide fire rated seals as required. See Division 07.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR EXAMINATION PRIOR TO ELECTRONIC SAFETY AND SECURITY INSTALLATIONS

- A. Verify conditions and constructions types prior to installation.
- B. Verify that surfaces that support Product(s) are ready to receive them.
- C. Examine location of equipment installation for compliance with installation tolerances and other conditions affecting performance of Work
 - 1. Prepare drawings showing proposed rearrangement of work to meet Project conditions, including changes to work specified in other Divisions. Obtain permission of Architect before proceeding.
- D. Review all Drawings including architectural, mechanical, structural, civil, and electrical drawings for extent of Work.
 - 1. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
- E. Examine Architectural drawings and elevations to verify device locations and mounting heights.
 - 1. In finished spaces, where mounting heights are not detailed or dimensioned coordinate mounting height with Architect.
 - 2. Do not rough-in for any wall mounted equipment without verifying mounting height with Architect unless equipment is specifically noted on Architectural Drawings.
 - 3. Do not scale dimensions from Electrical Drawings and verify all mounting heights noted on Electrical Drawings.
- F. Site Investigation
 - 1. Prior to beginning work, exam the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.
 - 2. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions prior to beginning work.
 - 3. Existing equipment, systems and installations whether or not they are not detailed on the drawings must be restored to their original condition.

3.02 COMMON REQUIREMENTS FOR PREPARATION TO INSTALLATION

- A. Equipment Wiring preparation
 - 1. Obtain and review shop drawings, product catalog data, etc. prior to roughing-in for electrical connections.
 - 2. Verify dimensions and final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - 3. Refer to equipment drawings and specifications in all specification Divisions for rough-in requirements.

- B. Hangers and Supports preparation
 - 1. Coordinate the installation of required supporting devices, inserts and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Strength of construction shall not be impaired.
 - 2. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations. Strength of construction shall not be impaired.
 - 3. Provide plywood backboards shall be primed and painted with (2) coats of Gray enamel prior to mounting any equipment, wiring, etc

3.03 COMMON INSTALLATION REQUIREMENTS FOR ELECTRICAL WORK

- A. Description Of Wiring Methods:
 - 1. All wiring shall be installed in accordance with applicable codes.
- B. Install products in accordance with NECA 1 and manufacturer's instructions.
- C. Install work in locations shown on drawings, unless prevented by Project conditions. Refer to architectural drawings for exact devices locations.
- D. Conform to arrangements indicated by Contract Documents, recognizing that the Work is shown only in diagrammatic form.
- E. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- F. Install materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- G. Core drilling of concrete is required, where possible, in lieu of hammer drilling. Hammer drilling is generally to be limited to small holes for anchors.
- H. Hangers and Supports
 - 1. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
 - 2. Do not fasten supports to pipes, ducts, mechanical equipment and conduit. Do not drill or cut structural members.
 - 3. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
 - 4. Install surface-mounted cabinets, disconnects, contactors, starters and panelboards with minimum of four anchors.
 - 5. In wet and damp locations use steel channel supports to stand cabinets, disconnects, contactors, starters and panel boards approximately one inch off wall.
- I. Floor, Wall And Ceiling Penetrations
 - 1. Effectively seal penetrations in exterior walls, roofs, and rated interior walls in accordance with Division 07.
 - 2. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access door units. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 3. Conduits and cables passing through floors, walls, and ceilings at the following locations shall be sealed for the purpose of sound, heat, smoke and / or moisture control.
 - a. Acoustically rated walls.
 - b. Fire and / or smoke resistant walls and floors.
 - c. All electrical rooms.
 - d. All mechanical rooms.

- e. Penthouse.
 - f. All exterior walls.
 - g. All vertical and horizontal shafts.
 - h. All walls around janitor rooms, receiving rooms, and other facility maintenance and management rooms.
 - i. Food service areas.
 - j. All Exam, Procedure, Consult, and similar type spaces.
4. Where conduits and raceways pass through interior walls and ceilings (not requiring water proofing) provide suitable sealing material complying with Division 07 for the wall construction; examples:
 - a. Plaster for plaster walls.
 - b. Joint compound for gypsum board walls.
 - c. Mortar for masonry block and brick walls.
 - d. Grout for concrete walls.
 5. Place sealing material around each conduit and raceway for the full thickness of the wall.
 6. Where conduits and raceways pass through exterior walls and ceilings below grade, provide installation to meet the details noted on the Drawings.
 7. Where interior walls require waterproof conduit and raceway seals, provide silicone sealant generally installed as specified above for exterior walls.
 8. Where conduits and raceways pass through exterior walls above grade, provide matching wall material inside (see examples above) and provide waterproof seal of silicone sealant or other approved sealant on outside.
 9. At the nearest point of access to wires (inside conduit or raceway) passing through exterior walls and roof; provide "Ductseal" between wires and conduit or raceway as a wind barrier.
 10. Where cables pass through walls, ceilings and floors, generally use same sealing method as for conduits.
 11. "Ductseal" type material is generally not acceptable except as noted above.
 12. Utilize fire rated cabling pathways where cabling must be routed through fire-rated floor and wall assemblies.
- J. Roof Penetrations
1. Electrical Contractor shall be responsible for providing roof seals for each raceway, mast, tower leg, guy wire, etc., which pass through roof, rest on roof or attach to roof. Avoid roof penetrations where possible. This work shall be performed by the Roofing Contractor. Electrical Contractor shall coordinate work as needed.
- K. Cutting, Patching, and Finishing
1. General: Perform cutting, patching and finishing in accordance with Division 01.
 - a. Cut, remove, and legally dispose of material including but not limited to construction material, and other indicated material made obsolete by the new work.
 - b. Protect the structure, furnishings, finishes, and adjacent materials and installations not indicated or scheduled to be cut or removed.
 - c. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt into adjacent areas.
 - d. The Contractor shall not endanger the stability of the structure by cutting, excavation or otherwise.
 - e. Do not cut or alter work of any other trade without trade and Architect / Engineer's consent.
 2. Perform cutting, patching and finishing of walls, floors, ceilings, roofs required to:
 - a. Uncover work to provide for installation of new or ill-timed work.
 - b. Remove and replace defective work.
 - c. Remove samples of installed work as specified for testing.

3. Upon written instructions from the Architect / Engineer, uncover and restore work to provide for Engineer's observation of concealed work.
 4. Should any cutting be required for proper installation of electrical work because of failure to give the General Contractor the proper information at the time required, such cutting shall be done at the Electrical Contractors expense.
- L. Equipment wiring installation
1. Provide all necessary boxes, raceways, and wiring required to make equipment and systems complete and operable.
 2. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.
 3. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components.
 4. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 5. Make electrical connections in accordance with equipment manufacturer's instructions.
 6. Make conduit connections to equipment using flexible metal conduit. Use liquidtight flexible metal conduit with watertight connectors in damp or wet locations.
 7. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
 8. Provide suitable receptacle outlet to accommodate connection with attachment plug.
 9. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
 10. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
 11. Install terminal block jumpers to complete equipment wiring requirements.
 12. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- M. Elevator wiring installation
1. Provide smoke detector in each elevator lobby.
 2. Provide smoke detector in each elevator equipment room.
 3. Provide smoke detector in each elevator shaft for machineroomless equipment.
 4. Provide fixed temperature heat detector within two-feet of each sprinkler head in the elevator equipment room and in the elevator hoistway, where applicable. Temperature setting shall be below rating of sprinkler head.
 5. Provide interconnection between elevator shunt trip switch with Fire Alarm and Detection System. Fire alarm system shall signal switch to operate upon alarm, and monitor voltage of shunt trip device.
 6. Provide interconnection between elevator shunt trip switch and elevator controller. Signal elevator controller battery lower device when power to the switch has been lost.
 7. Provide interconnection between elevator and Fire Alarm and Detection System for elevator recall to primary and secondary levels.
 8. Provide keyed switch at main floor elevator lobby for manual operation of elevator hoistway smoke removal system. Provide indicator light wired to position switch of hoistway damper indicator light shall be illuminated when damper is closed.
 9. Provide (1) circuit for the elevator car lighting circuit. Circuit shall originate from the Life Safety Distribution System where such system is installed within the facility. Provide lockable disconnect switch inside elevator equipment room.
 10. Provide (1) circuit for elevator pit weatherproof, GFCI receptacle and elevator pit lighting. Provide lockable disconnect switch inside elevator equipment room.

11. Provide (1) circuit for elevator pit weatherproof, GFCI receptacle, elevator pit lighting, and top of hoistway lighting. Provide lockable disconnect switch inside elevator equipment room.
12. Provide (1) circuit for light and GFCI receptacle in elevator equipment room where applicable. Provide lockable disconnect switch inside elevator equipment room.
13. Provide telephone connection to elevator cab telephone.
14. Provide (2) telephone connections to the elevator control panel.

3.04 EQUIPMENT AND DEVICE MOUNTING HEIGHTS

- A. Coordinate final mounting heights as directed under Part 3 paragraph "Preparation".
- B. Interior mounting heights indicated on drawings are from finished floors (interior) or final grade (exterior). Mounting heights for items indicated on exterior walls are from the interior finished floor below.
- C. Mounting heights indicated are to the top of the device plate unless noted otherwise. Mounting heights are nominal and shall be adjusted to fit block joints.
- D. Typical mounting heights are detailed on the Drawings.
- E. Handicapped counter and lavatory locations: meet ADA requirements for receptacle and switch locations and elevations.
- F. Contractor shall verify mounting heights of all outlets to assure installation above top of radiation covers, mirrors, counters, vanity, cabinets, and any other obstruction that may alter indicated mounting heights. ADA accessible controls must be mounted at 48".

3.05 COMMON REQUIREMENTS FOR OWNER INSTRUCTION AND DEMONSTRATION

- A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment and operation of all parts of the electronic safety and security equipment to the Owner's employees who are to have charge of the equipment. Including but not limited to the following:
 1. Demonstrate the proper operation of systems per the operational and function requirements of the Contract Documents and as outlined in any sequence of operation.
 2. Instruct personnel, in all phases of operation, location of components and use of all systems.
 3. Review manufacturer Warranty information for all equipment included in the manual.
- B. Number of hours of instruction shall be specified in other sections of this specification.
- C. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- D. Owner instruction / demonstration shall be provided as noted below and as noted in specification sections (see individual specification section for additional requirements):
 1. Identification for Electrical Systems - review naming conventions, color schemes, warning labels, posted operating instructions, bolted connection labels, etc.
 2. Fire Alarm and Detection System - review fire alarm drill procedures, monitoring company requirements, service agreements, other information required in specification section.
- E. Documentation: Upon completion of Owner Instruction and Demonstration provide a certificate signed and dated by the attendees indicating information covered, amount of instruction / demonstration time provided, and applicable specification sections. Provide certificate for all Owner Instruction and Demonstration sessions. Include copy with O & M Manual. A sample certificate is attached for reference.

3.06 FIELD QUALITY CONTROL

- A. So far as possible contractor shall keep same foreman and workmen throughout project duration. Keep enough workmen on job to insure keeping up with or ahead of other trades so that no delays occur.
- B. Delivery, Storage, and Handling
 - 1. Deliver, store, protect and handle products on site under provisions of Division 01 according to manufacturer's recommendations and as specified herein.
 - 2. This Contractor shall make provisions for delivery and safe storage of materials.
 - 3. Accept Products on site. Inspect for damage
 - 4. Protect Products from corrosion and entrance of debris. Provide appropriate covering. During construction, it shall be the responsibility of this Contractor to protect the surface of equipment and material furnished.
 - 5. See individual specifications sections for specific delivery, storage, handling and protection requirements.

3.07 CLEAN-UP, KEY CONTROL, AND PAINTING

- A. Remove all packing materials, rubbish, debris, etc. from the site each day.
- B. String all furnished keys on split metal key ring and turn same over to Owner at project completion.

END OF SECTION

SECTION 28 3116 - FIRE ALARM AND DETECTION SYSTEM EXTENSIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes fire alarm and detection system, including, but not limited to, the following:
 - 1. Fire alarm control unit - expansion.
 - 2. Initiating devices.
 - 3. Notification appliances.
 - 4. Control devices.
 - 5. Supervisory devices.
 - 6. Power supplies.
 - 7. Wiring.
 - 8. Testing.

1.02 RELATED SECTIONS

- A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 26, 27, 28.
- B. Division 07 (Section 07 8400) - Firestopping.
- C. Division 08 - Door Hardware.
- D. Division 21 - Sprinkler System
- E. Division 25 - Automatic Temperature Controls.
- F. See Section 26 0500 Common Work Results for Electrical for hangars and supports.
- G. See Section 26 0533 for conduit and raceways.
- H. See Section 26 0553 Identification for Electrical Systems.

1.03 REFERENCES

- A. UL 1424 - Cables for Power-Limited Fire-Alarm Circuits.
- B. UL 2196 - Tests for Fire Resistive Cables.

1.04 DEFINITIONS

- A. Qualified Service Personnel / Representative: Personnel qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be include, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. International Municipal Signal Association (IMSA) fire alarm certified.
 - 4. Certified by a state or local authority.
 - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
 - 6. Personnel licensed or certified by state or local authority.

1.05 SCOPE OF WORK

- A. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of extensions to the existing fire alarm and detection system as indicated on the drawings and specifications. The system extensions shall be complete and the system shall be left fully operational.

1.06 DESCRIPTION OF SYSTEM

- A. The existing system manufacturer is: Simplex (JCI) model 4100ES.

- B. General: Non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- C. Wiring/Signal Transmission:
 - 1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
 - 2. System connections for initiating, signaling line circuits and notification appliance circuits shall be Class B.
 - 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- D. Remote Access:
 - 1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system.
 - 2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
 - 3. FACP shall have the capability to provide third party access through a serial interface connection and be agency listed for specific interfaces and for the purpose.
 - 4. FACP shall have the capability to provide remote access via an Internet/Intranet Interface. The Internet interface shall provide an alternative access to system information using the familiar interface of a standard Internet browser. A remotely located fire professional can use this access to analyze control panel status during non-alarm conditions and can also use this information to assist local fire responders during alarm conditions.
- E. Required Functions: The following are required system functions and operating features:
 - 1. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
 - 2. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location / zone and type of device.
 - 3. General Alarm: A system alarm shall include:
 - a. Indication of alarm condition at the FACP and the annunciator(s).
 - b. Identification of the device /zone that is the source of the alarm at the FACP and the annunciator(s).
 - c. Operation of audible and visible notification devices on the fire floor, floor above and floor below until silenced at FACP.
 - d. Selectively closing doors normally held open by magnetic door holders on the fire floor, floor above and floor below.
 - e. Unlocking designated doors.
 - f. Shutting down supply and return fans serving zone where alarm is initiated.
 - g. Closing smoke dampers on system serving zone where alarm is initiated.
 - h. Initiation of smoke control sequence through the building temperature control system.
 - i. Notifying the local fire department.
 - j. Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.
 - 4. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
 - a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
 - b. Transmission of supervisory signal to remote central station.

- c. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
 - d. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
- 5. System Reset
 - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b. Should an alarm condition continue, the system will remain in an alarmed state.
- F. Analog Smoke Sensors:
 - 1. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
 - 2. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
- G. Audible Alarm Notification: By horns in areas as indicated on drawings.
- H. Fire Suppression Monitoring:
 - 1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 - 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
 - 3. WSO: Water flow switch and sprinkler valve tamper switch shall be connected to dedicated individual addressable monitoring devices. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- I. Power Requirements
 - 1. Provide additional battery capacity to ensure that the system has sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 10 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
 - 2. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

1.07 REGULATORY REQUIREMENTS

- A. Upon completion the system extensions and all associated operations shall be in accordance with the following Codes:
 - 1. International Building Code, IBC
 - 2. International Fire Code, IFC
 - 3. State of Minnesota Fire Codes and Building Codes.
 - 4. NFPA 72, National Fire Alarm Code
 - 5. NFPA 70, National Electrical Code
 - 6. NFPA 101, Life Safety Code
 - 7. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
 - 8. Other applicable NFPA standards
 - 9. Local Jurisdictional Adopted Codes and Standards
 - 10. ADA Accessibility Guidelines.

1.08 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in smoke detection, fire, and mass notification alarm systems with five years experience.
- B. The Manufacturer shall be a nationally recognized company specializing in fire alarm and detection systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 100 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry.
- C. System Integrator: Company specializing in smoke detection, fire, and mass notification alarm systems with five years experience and that have personnel who possess a full knowledge and understanding of systems used for fire alarm and that have factory-trained personnel to perform system design installation, testing, training, and maintenance.
- D. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems.
- E. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.09 MAINTENANCE SERVICE

- A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
- B. Basic Services: Systematic, routine maintenance visits on a twice annual basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Occupancy Adjustments (Included under Basic Services): When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.
- D. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- E. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

1.10 SUBMITTALS FOR REVIEW

- A. Submit the following according to the requirements of Division 01 and Section - Electrical General Requirements.
- B. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
- C. Wiring diagrams from manufacturer.
- D. Shop drawings showing system details including location of FACP, all devices, circuiting, device wiring details, and details of graphic annunciator (if applicable).
- E. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.

- F. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, Sensor, and auxiliary control circuits.
- G. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

1.11 SUBMITTALS FOR INFORMATION

- A. Submit the following according to the requirements of Division 01 and Section - Electrical General Requirements
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.12 SUBMITTALS FOR CLOSEOUT

- A. Submit the following according to the requirements of Division 01 and Section 26 0100.
- B. Operation and Maintenance Manuals:
 - 1. In addition to information required by section "Operation and Maintenance of Electrical Systems", provide a Fire Alarm System Record of Completion in accordance with NFPA 72. Submit on form similar or identical to Figure 4.5.2.1 from NFPA 72.
 - 2. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
 - 3. Operating instructions for FACP.
 - 4. Record of field tests of system.
- C. Project record drawings. Note revisions to approved shop drawings.

PART 2 PRODUCTS

2.01 FIRE ALARM CONTROL PANEL (FACP)

- A. The manufacturer and model of the existing system are noted above.
- B. The Contractor shall provide all hardware and software required for the specified system extensions.
- C. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

2.02 EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid or nickel cadmium type. Provide additional battery capacity sufficient to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.03 ADDRESSABLE DEVICES - GENERAL

- A. Provide address-setting means.
- B. Detectors shall be ceiling-mounted and shall include separate twist-lock base with tamper-proof feature.
- C. Detectors shall provide test means whereby they will simulate alarm condition and report that condition to control panel. Such test shall be initiated at detector itself by activating magnetic switch or initiated remotely on command from control panel.

- D. Connect to fire alarm control panel's Signaling Line Circuits.
- E. Addressable Thermal and Smoke Detectors: Provide status LEDs. LEDs shall flash under normal conditions, indicating detector is operational and in regular communication with control panel, and LEDs shall be placed into steady illumination by control panel, indicating alarm condition has been detected. If required, flashing mode operation of detector LEDs can be programmed off via fire control panel program.
- F. Fire Alarm Control Panel: Permit detector sensitivity adjustment through field programming of system. Sensitivity can be automatically adjusted by panel on time-of-day basis.
- G. Using software, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. Detectors shall be listed by UL as meeting calibrated sensitivity test requirements of NFPA 72.
- H. Detectors shall provide test means whereby they will simulate alarm condition and report that condition to control panel. Such test shall be initiated at detector itself by activating magnetic switch or initiated remotely on command from control panel.
- I. Detectors shall store internal identifying type code that control panel shall use to identify type of device (ION, PHOTO, THERMAL).

2.04 ADDRESSABLE MANUAL PULL STATIONS

- A. Semi-flush mounted, double action manual station, addressable.
- B. Non-code, non-break glass type, equipped with key lock so they may be tested without operating handle.
- C. Operated Station: Visually apparent, as operated, at a minimum distance of 100 feet (30.5 m) from front or side.
- D. Stations shall be designed so after actual activation, they cannot be restored to normal except by key reset.
- E. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on cover. The word FIRE shall appear on front of stations in raised letters, 1.75 inches (44 mm) or larger.
- F. Addressable manual stations shall, on command from control panel, send data to panel representing state of manual switch and addressable communication module status.

2.05 SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.
 - 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - 4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
 - 5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 - 6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 - 7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the

- control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
8. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
 9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 10. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.
 - C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
 - D. Provide integral sounder base (88 dBA) where indicated
 - E. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
 1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
 9. Where indicated provide NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.06 HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.07 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for

monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.

- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
- C. There shall be the following types of modules:
 - 1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 - 2. Type 2: Line Powered Monitor Circuit Interface Module
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - b. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - 3. Type 3: Single Address Multi-Point Interface Modules
 - a. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - b. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - c. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.
 - 4. Type 4: Line Powered Control Circuit Interface Module
 - a. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
 - 5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module
 - a. This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.
- D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a

troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.08 STANDARD ALARM NOTIFICATION APPLIANCES

- A. Horn: Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.
- B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
- C. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.
- D. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
- E. Alarm lights, horns, speakers shall have white lettered FIRE on red lens.
- F. Alarm lights, horns, speakers shall have red lettered FIRE on white lens.
- G. Accessories: The contractor shall furnish the necessary accessories.

2.09 DEVICE GUARDS

- A. Welded wire mesh, matched to the size and shape of the manual station, detector, indicating device. Painted to match the device.

2.10 AUXILIARY DEVICES

- A. Door Release: Door closer as specified in Division 08.
- B. Magnetic Door Holder: with integral diodes to reduce buzzing, 24 VDC 120 VAC coil voltage.

2.11 CONDUIT AND BOXES

- A. Conduit shall be as specified in Section - Raceways and Boxes for Electrical Systems.
- B. Conduit shall have red pigmentation.
- C. $\frac{3}{4}$ " diameter minimum.

2.12 FIRE ALARM WIRE

- A. Provide wiring as recommended by manufacturer and by system vendor in compliance with local codes.
- B. Conductors shall comply with NFPA 70 Article 760. Conductors shall be stranded copper.
- C. Number and size of conductors will be as specified by the manufacturer (not less than 18 AWG for SLCs and IDCs, and 14 AWG for NACs). All wires shall be color coded as suggested by the Manufacturer.
- D. Power Limited Circuits: 300-volt minimum rated.
- E. Non-Power Limited Circuits: 600-volt minimum rated.
- F. RHW and RHH type cable shall not be acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as shown on Drawings and instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

- A. Notify the Authority Having Jurisdiction, prior to installation and / or alteration of existing system.
- B. Review manufacturer's approved shop drawings prior to beginning installation.
- C. Coordinate mounting heights with Architect, manufacturer's installation instructions, and applicable code requirements.
- D. Coordinate route of any required surface mounted conduit and / or raceway located at a public or finished space with Architect prior to rough-in.
- E. Coordinate detector locations with luminaires and air supply and return grilles.
- F. Coordinate location of duct mounted detectors with mechanical contractor.
- G. Elevator shaft and equipment room, coordinate temperature rating and location of heat detectors with sprinkler head rating and location.

3.03 INSTALLATION

- A. Beginning of installation means installer accepts conditions.
- B. Install system components and all associated devices in accordance with manufacturer's approved shop drawings, applicable Building Codes, Fire Codes, and NFPA Standards. All devices shall be mounted and installed to comply with NFPA 72 and to meet ADA requirements.
- C. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- D. Install similar devices at the same height unless noted otherwise.
- E. All wiring under this Section shall be in enclosed raceway.
- F. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- G. Make conduit and wiring connections to all devices required for complete system operation as noted on drawings and specified herein.
- H. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- I. Smoke and Heat Detector Spacing:
 - 1. Comply with NFPA 72 "Initiating Devices" chapter for spacing of smoke and heat detectors.
 - 2. Locate detectors 3-feet away from air-supply diffusers and return air openings minimum.
 - 3. Locate detectors 1-foot away from light fixtures minimum.
- J. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes to extend the full width of the duct.
- K. Audible Alarm Indicating Devices: Install not less than 6-inches below ceiling.
- L. Visible Alarm Indicating Devices: Install bottom of lens 80-inches above finished floor minimum, and at least 6-inches below ceiling.

- M. Annunciator: Install top of panel not more than 72-inches above finished floor.
- N. Provide individual addressable modules:
 - 1. At each smoke damper.
 - 2. For each elevator controller.
 - 3. For each elevator shunt trip enclosed switch or circuit breaker.
 - 4. To provide supervisory connections at valve supervisory switches.
 - 5. To provide supervisory of elevator shunt trip switch or circuit breaker.
 - 6. As needed for the functions described herein and on the plans.
- O. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- P. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AH) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- Q. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- R. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.04 FIELD QUALITY CONTROL

- A. Utilize manufacturer's approved shop drawings during installation.
- B. Manufacturer's Field Services: Provide services of a factory-authorized qualified service representative to supervise the field assembly and connection of components and the pretesting, and final testing.
- C. Performance Verification Testing
 - 1. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications.
 - a. Correct deficiencies observed in pretesting.
 - b. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
 - 2. Test the system according to the procedures outlined in NFPA 72.
 - 3. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies.
 - 4. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- D. Acceptance Testing (By the Authority Having Jurisdiction)
 - 1. Contractor shall schedule test.
 - 2. Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing to be provided by the Authority Having Jurisdiction.
 - 3. Notify Architect of any deficiencies.

3.05 OWNER INSTRUCTION AND TRAINING

- A. Provide the services of a factory-authorized qualified service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 6 hours' training.

2. Provide a two 3-hour training sessions on two different days unless requested otherwise.
3. Schedule training with the Owner at least seven days in advance.
4. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.

3.06 DOCUMENTATION

- A. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

3.07 CLEANING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean devices internally using methods and materials recommended by manufacturer.

END OF SECTION

SECTION 32 3113 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Posts, rails, and frames.
- B. Wire fabric.
- C. Barbed wire.
- D. Manual gates with related hardware.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2022).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- D. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.
- E. CLFMI CLF-SFR0111 - Security Fencing Recommendations; 2014.
- F. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Line Posts: 1.9 inch (48 mm) diameter.
- B. Corner and Terminal Posts: 2.38 inch (60 mm) diameter.
- C. Fabric: 2 inch (51 mm) diamond mesh interwoven wire, 6 gauge, 0.1920 inch (4.9 mm) thick, top selvage knuckle end closed, bottom selvage twisted tight.
- D. Tension Wire: 6 gauge, 0.1920 inch (4.9 mm) thick steel, single strand.
- E. Tie Wire: Aluminum alloy steel wire.

2.02 MATERIALS

- A. Posts, Rails, and Frames:
 - 1. Formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, HSLAS, Grade 50, with G90 (Z275) zinc coating.
- B. Line Posts: Type I round in accordance with FS RR-F-191/1D.
- C. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
- D. Wire Fabric:
 - 1. ASTM A392 zinc coated steel chain link fabric.
- E. Type specified in Section 03 3000.

2.03 MANUAL GATES AND RELATED HARDWARE

- A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.
- B. Hinges: Finished to match fence components.
- C. Latches: Finished to match fence components.

2.04 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

2.05 FINISHES

- A. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Place fabric on outside of posts and rails.
- C. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- D. Line Post Footing Depth Below Finish Grade: ASTM F567.
- E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- F. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.
- G. Provide top rail through line post tops and splice with 6 inch (150 mm) long rail sleeves.
- H. Install center brace rail on corner gate leaves.
- I. Do not stretch fabric until concrete foundation has cured 28 days.
- J. Stretch fabric between terminal posts or at intervals of 100 feet (30 m) maximum, whichever is less.
- K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches (380 mm) on centers.
- L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- M. Install bottom tension wire stretched taut between terminal posts.
- N. Do not attach the hinged side of gate to building wall; provide gate posts.
- O. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

3.02 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Position: 1 inch (25 mm).

END OF SECTION

